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DECEMBER 1995

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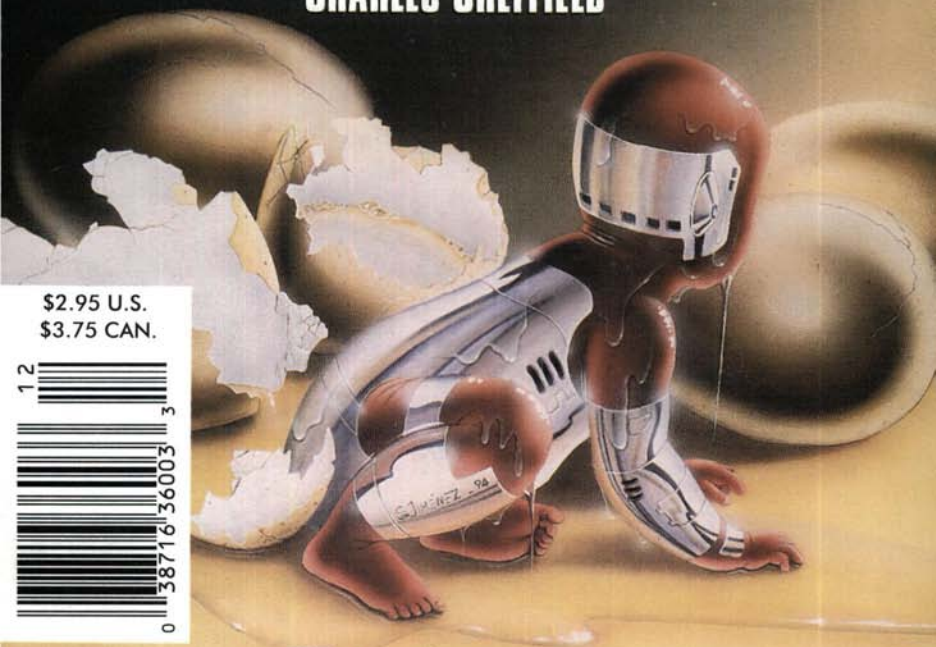

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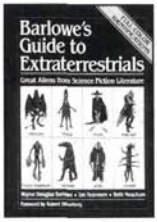

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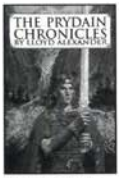

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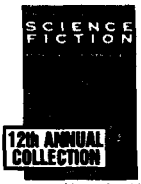

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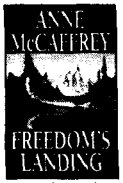

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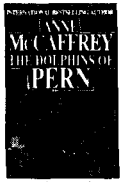

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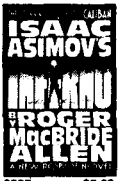

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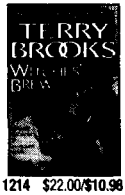

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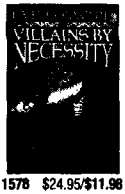

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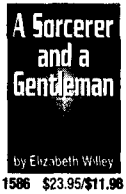

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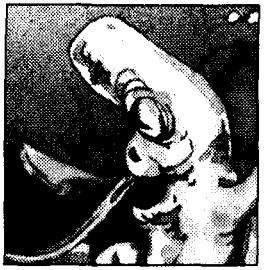

98

Vol. CXV No.14
December 1995

Next Issue on Sale
November 7,1995

Serial

CETAGANDA (Part Three of Four), Lois McMaster Bujold ____ 10

Novelettes

GARBAGE IN, GARBAGE OUT, Grey Rollins ____ 98
THE THIRD WAVE, Alexis A. Gilliland ____ 120

Science Fact

A HANDFUL OF HERESIES, Charles Sheffield ____ 62

Short Stories

A MORE PERFECT UNION, Doug Larsen ____ 74
THE MAZE, Paula Robinson ____ 86

Reader's Departments

THE EDITOR'S PAGE ____ 4
THE ALTERNATE VIEW, John G. Cramer ____ 93
THE REFERENCE LIBRARY, Tom Easton ____ 162
BRASS TACKS ____ 169
IN TIMES TO COME ____ 174
UPCOMING EVENTS, Anthony Lewis ____ 176

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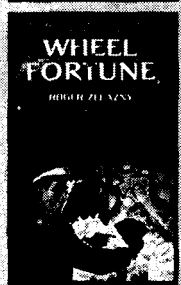

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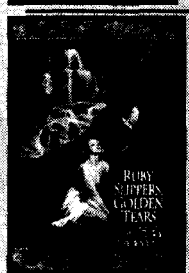

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RELEVANCE

Back about 1970, there was a sudden burst of demands by students for "relevance" in their studies. They didn't want to be bothered with subjects that didn't have a direct and obvious application to the social problems of the day, such as the Viet Nam war and the suddenly popular concern for the environment. A lot of people were *very* concerned about such things then; and many teachers, seeing no realistic alternative, acquiesced at least somewhat to the demands.

The demand for relevance was, in part, a fad, and, like so many others, eventually subsided. It has seldom been heard quite so widely or so stridently since—but it didn't go away completely. We still hear mutterings, from time to time, that this or that—space travel, for instance—is not worth doing because it's not "relevant." Relevance *is* sometimes important—but not necessarily in the senses and for the reasons that those students had in mind.

From a teacher's point of view, relevance is not so much a quality that everything *needs* to have, as one that can serve as a valuable motivational tool when something *does* have it. You must remember, first of all, that the concept is meaningless in a vacuum. Things are not *intrinsically and absolutely* relevant, but only relevant *to* something else. There are so many elements and relationships in the world that most things *are* relevant to at least something else, and many teachers need to make more effort to point those connections out. A student who is interested in *A* but not *B* may suddenly pay more attention to *B* if he realizes he can use it in *A*.

Even very good teachers sometimes miss, or forget, this point. I remember being perplexed as an undergraduate by the very different opinions my classmates held of a particular professor. Some of us thought he was outstanding. Many others thought he was hopelessly boring. How could we be talking about the same man?

I think I figured it out, much later. Those of us who admired him came to the class wanting to learn physics, and he had a knack for making very clear the things we wanted to know. But he made little effort to create an interest in the subject in students who didn't already have one, and those were the ones who found him boring. He was an extremely good teacher for those of us who knew we wanted to learn his subject—and, I must now sadly agree, not a very good one for those who didn't.

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He could have been an even better teacher by reaching more students, but to do that he would have had to make an additional effort to "wake up" the ones who didn't want to be there. One way he could have done that would have been to explicitly point out ways that his general principles applied to other fields that did interest them—how, for example, principles of hydraulics directly govern the circulatory systems that would occupy so much of the future professional attention of premeds.

There is certainly room for debate about how much of a teacher's attention should go into trying to coax and cajole students who have failed to figure out why they're there. My personal view is that such efforts should not be allowed to dilute the substance of what's delivered to those who want to learn. On the other hand, the empirical fact is that some classes (such as physics for premeds) routinely contain a high percentage of "captive" students. When I'm teaching such a class, I can't believe I'm doing a very good job if I use their reluctance and ignorance as an excuse to let them out without learning anything. So when I taught such classes (and I sometimes *asked* for them because I considered them a challenge), I tried to provoke both interest and accomplishment in as many students as I could. I used whatever methods I could find that worked, and demonstrating relevance to their own strong interests was one of the most reliable.

I can also think of many examples from a student's point of view—both things that *were* done, and things that I later *wished* had been done. In the early stages of learning to fly an airplane, I sometimes wondered why so much of my time was spent being made to do difficult things bearing little resemblance to things done in the normal course of flying. What was the point, for instance, of spending a whole hour of instructional time making the plane stall in various ways, or flying tight circles around a barn on a windy day? Eventually I saw that all those weird exercises were really aimed at developing skills needed for the one supremely important and difficult thing a pilot must do on every trip: land the plane in one piece. Might I have found those early hours less trying if somebody had *explained* that to me then?

Maybe. But the main value of such advice is as a tip to teachers on how to keep students more interested through

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distasteful things they must learn, by telling them why they must learn them. Where the students demanding relevance sometimes went too far—and so did some teachers who let themselves be pressured—was in believing that students should unilaterally decide what is relevant and worth studying. Letting them do that is unrealistic, and likely to cheat the students themselves in ways that even they would recognize eventually—but too late. Students, by the very nature of the incompleteness of their present knowledge, are not always in a good position to *know* what is relevant or important.

The flying example is but one illustration. A student who hasn't been told why practicing stall recoveries and circles around a point is important might well grumble that they're "irrelevant" and demand to skip them and get on to the fun stuff. But an instructor would be a fool to listen to such demands. A landing is a precision maneuver done at or near stall conditions, and it *must* be done *right* under all kinds of wind conditions. So every pilot must be very familiar with what stall conditions feel like and how to cope with varying winds. Those "irrelevant" maneuvers provide excellent ways to learn those things at a safe distance from the ground.

It simply isn't possible to judge how you're going to like a field when you haven't tried it, or apply a technique when you haven't yet learned it. Differential equations have never been popular, even among physics students, but you can't go very far in physics without needing them on an everyday basis. My wife now wishes somebody had made her study more music, and some Polish (her ancestral language), when she was little; and I now agree that it would have been to her present benefit if they had.

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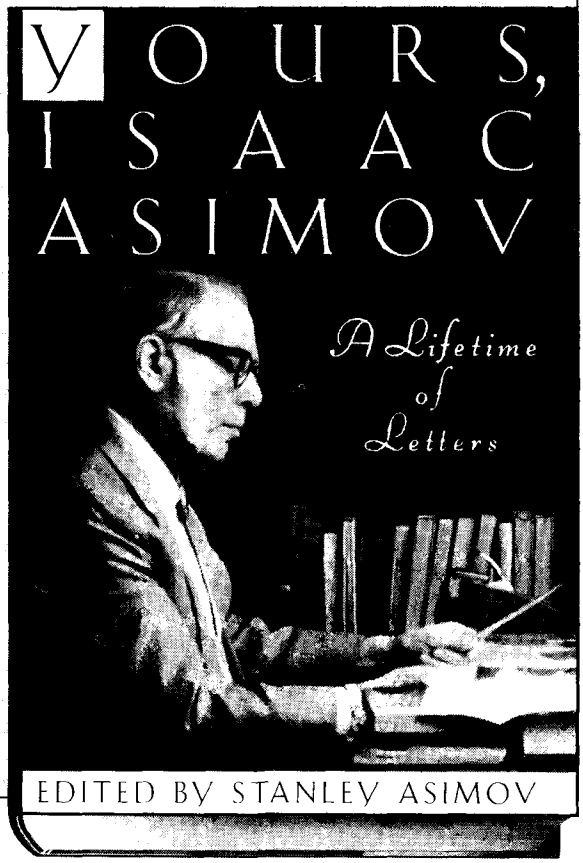

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In my own case, I developed an interest in musical composition early, with fairly grandiose ambitions: I wanted to write symphonies. The kinds of symphonies I thought I'd like to write were more like those of Shostakovich and Mahler than those of Mozart and Haydn—but years later, I found myself wishing somebody had made me study the structure of Mozart and Haydn's whether I found them boring or not. The *basics* of form are much easier to see in the earlier composers, and the later ones are easier to understand if you can see how their methods *evolved* from the earlier. But of course I couldn't see that until I'd learned quite a bit about both, by a harder method than necessary. . . .

What it boils down to, I think, is this. In education (as in many other areas) a double standard—in the right sense—can actually benefit everybody. Students should make sure their teachers know as much as possible about what they're interested in, but they should recognize that their teachers may know something they don't about what's needed to pursue those interests. Teachers should bear in mind that it's their obligation to provide what students are going to need, whether they currently recognize the need or not—but part of the job is to show them *why* it's a need.

Finally, everybody—whether or not they're currently involved with formal education in *any* capacity—should bear in mind that you can't always *know* what will turn out to be important sometime in the future. Somebody once asked one of the pioneers in the development of electricity, "What good is it?" His reply was, "What good is a newborn baby?"

Personally, I've always been an informational pack rat (which, as it turns out, is a very useful thing for an *Analog* editor to be!). I tend to save more information than many people do (or think reasonable), and over and over I've found some bit of it proving useful many years later—not for what I'd anticipated it *might* be useful for, but for something I couldn't have anticipated at all. I saved notes from astronomy courses I taught years ago, figuring I might use them as a starting point if I ever found myself teaching such a course again. So far I haven't; and if I ever do, the new course will need a lot of updating—but the old notes were surprisingly helpful in thinking about the organization of a book I unexpectedly found myself writing last year. Over the years I've given many slide shows, on a variety of topics for a variety of audiences, and usually saved scripts in case I ever found myself called upon to give the same show again. That's very seldom happened—but those old scripts much later turned out to be a great labor-saver in developing a computer aid for editing *new* shows on new topics.

If you *know* something is relevant to something you want or need to do, that gives you an extra incentive to pay attention to it. If you *don't* see its relevance, that proves only that you don't see it—not that it doesn't and never will have any. In a rapidly changing world, making "relevance" one of your primary goals is a dangerously short-sighted way to live. If you insist that everything you do or learn be relevant to the problems of today, you may leave yourself utterly unprepared to deal with those of tomorrow. ■

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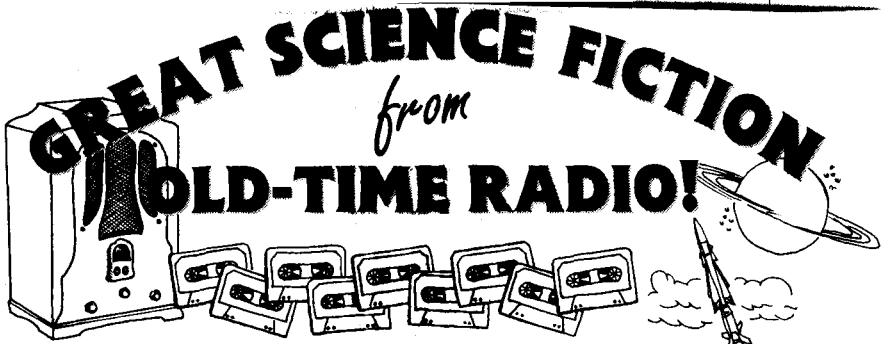

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Once you have the ability to shape genomes, what do you do with it? For Cetaganda, the answer was central, but far from simple.

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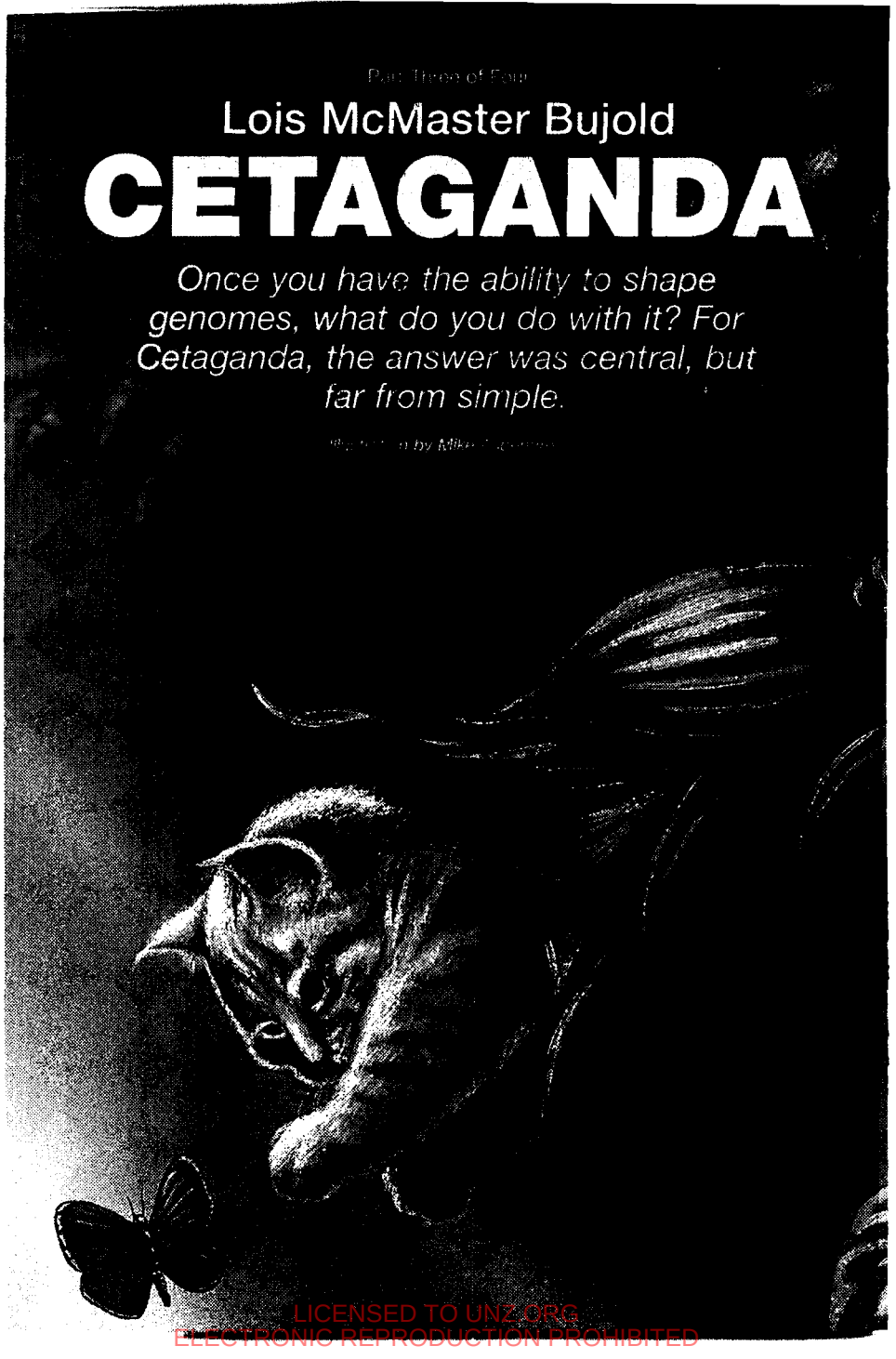

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SYNOPSIS

Lieutenant Lord **Miles Naismith Vorkosigan** *and his cousin Lieutenant Lord* **Ivan Vorpatril** *arrive in orbit at the planet of Eta Ceta, capital of the Cetagandan Empire, to be official Barrayaran envoys to the State funeral of the aged Dowager Empress* **Lisbet Degtiar**. *But their personnel pod, upon docking, is boarded by a stranger with no facial hair. Believing the intruder is drawing a weapon, they jump him. Miles relieves the stranger of a lethal nerve disruptor and a mysterious rod, apparently electronic in function, sealed by a code-lock patterned in the shape of a red bird. The intruder escapes. Miles pockets the spoils, assuming he will have to give them up shortly to the Cetagandan authorities, but after a second docking the two young envoys are collected by the Barrayaran ambassador Lord* **Vorob'yev** *and wafted through Cetagandan customs with no questions asked.*

That evening, Vorob'yev takes them to a diplomatic reception at another embassy in the legation district. Miles meets **Mia Maz**, *an expert in women's protocol from the Vervani embassy, to whom he describes the seal-pattern from his mysterious rod; she identifies it as a Cetagandan cartouche, and promises to look up its provenance. An artistic young Cetagandan ghem-lord named* **Yenaro** *escorts Miles through his work, an elaborate fountain-maze. Inside, Miles discovers the magnetic field that drives the swirling leaf-patterns has an unfortunate side-effect on his metal leg-braces, bringing them up to skin-burning temperature. Miles yells and pelts out of the maze, making a public spectacle of himself, and convinced that the artwork was a subtle trap set just for him.*

The next day Miles and Ivan attend the presentation of bier-gifts to the dead empress at the Celestial Garden, a great force-dome at the center of the city that houses the Cetagandan emperor and all Imperial panoply. A hairless palace servitor escorts Miles to a haut-lady who, as is customary, is totally concealed in an opaque white force-bubble, shielded from outlander eyes. The bubble introduces herself as the haut **Rian Degtiar**, *attendant to the late empress and Handmaiden of the Star Crèche. Miles learns from her that the hairless ones are called Ba, genderless genetically-engineered Imperial slaves of considerable status. After a very confused conversation, Miles realizes that the rod-shaped device is her property, and she is accusing him of stealing it. He hastily promises to return it.*

In the rotunda housing the empress's bier, the ceremony goes awry. Miles ducks through the line of ghem-guards around the catafalque to see what the problem is. He finds the dead body of an aged ba in the uniform of a palace sevitor, its throat cut by the knife in its right hand—their intruder from the docking bay. Miles learns it is the Ba Lura, one of the late empress's oldest and most trusted servitors, who has apparently suicided at her feet.

Back at the Barrayaran embassy, Mia Maz gives Miles and Ivan a tutorial in Cetagandan customs. The Star

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Crèche is the haut-lord gene bank; all haut conceptions including any genetic alterations are created therein. All activities of the Star Crèche are presently on hold until the dowager's successor is appointed by the emperor. The ghem-lords, who serve the haut themselves are half-haut, descendants of Cetagandans of extraordinary merit and the haut wives with which the emperor occasionally rewards them. To his concealed horror, Miles learns that his rod is the Great Key of the Star Crèche, a major piece of Imperial regalia, which is supposed to be turned over to the dowager's successor at the end of the official period of mourning. After Maz departs, Miles promises the panicked Ivan that he will get rid of the incriminating rod very soon now. Both are afraid the Ba Lura cut its throat in shame for losing the Great Key, making its death their fault.

The next evening, Miles and Ivan attend a party at Lord Yenaro's rundown suburban mansion. Miles discovers that Yenaro is best known as a perfumer, not a sculptor. Miles meets a ghem-lady, who invites him for a walk in the garden—only to turn him over, at the back gate, to the hairless ba who had escorted him to the haut Rian at the Celestial Garden. The ba leads Miles to where the glowing white bubble again awaits.

Miles learns that the Ba Lura, before its death, told the haut Rian a false tale of being overpowered by six Barrayarans, and the Key deliberately stolen. Miles offers his own version of the encounter, and presses Rian to explain what the Ba was doing on an orbital transfer station with the Great Key in the first place. She claims the Ba was stealing it. But where was Lura taking the Key? Miles offers to return the Key to Rian face-to-face, forcing her to drop her bubble. A small triumph: he is going to see a haut woman, and Ivan isn't.

The haut Rian proves no old lady, but an ethereal woman of icon-like reserve, clothed in the white of mourning. The impact of her beauty knocks Miles to his knees, lost in ebony hair and ice-blue eyes. He lays the Great Key at her feet, thinking, I am Fortune's Fool.

The haut Rian attempts to open the Great Key with a code ring. Nothing happens. The Key is either broken, sabotaged, or a decoy, and Miles is the last person to have had it in his possession. Miles learns the Key is not merely ceremonial, but the sole decoder for the haut race's central gene bank. There is no back-up. Miles demands an explanation of why the Ba Lura ever removed it from the Celestial Garden.

Haltingly, Rian reveals a plot by the late empress. Lisbet had long felt the haut race was too centralized and genetically narrow, and wished dispersal of copies of the gene bank to each of the Cetagandan Empire's eight planetary satrapies, a move her son the emperor opposed for security reasons. So she'd had copies made in secret, and charged the Ba Lura and Rian to deliver them to each of the satrap governors on the occasion of her funeral, which they would all be sure to attend. This, Rian informs Miles, has already been accomplished.

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But Empress Lisbet died earlier than she'd expected, before she had arranged copies of the Great Key. Ba Lura, against Rian's judgment, wished to take the Key to one of the governors for duplication, and apparently was trying to do so when it ran afoul of the Barrayarans. The political side-effects of this mitosis of the gene bank could include the break-up of the Cetagandan Empire into civil war and eight new expanding centers, a nightmare concept for Cetaganda's neighbors such as Barrayar. And . . . Rian does not know which *satrap governor the Ba Lura was trying to contact.*

Miles begins to suspect the Ba Lura in fact succeeded, and hit the Barrayarans not on the way to *its meeting with the satrap governor, but on the way* back. *The Barrayarans will be the substitution, leaving the satrap governor to sneak home with the only copy of the real Great Key. The Ba was murdered by the unknown satrap governor to eliminate the only, witness to the truth. Rian is doubtful, but promises to do what investigating she can inside the Celestial Garden.*

Miles returns to Yenaro's party, where Ivan reappears in a state of well-suppressed rage, claiming in an undervoice that he thinks he's been poisoned. The two cousins hurriedly depart. In the embassy groundcar, Ivan confides that he was taken up stairs by two beautiful ghem-women, **Lady Arvin** *and* **Lady Benello,** *and seduced—up to a point, when it became apparent to him that sometime during the evening Yenaro had slipped him an anti-aphrodisiac. Ivan rose to the occasion in the only way he could, making up a lot of instant barbarian folklore about a Vor lord's self-control, and leaving his fascinated ghem-lady audience satisfied by other means. To Miles, it seems another elaborately humiliating trap like his encounter with the sculpture that fried his legs.*

The next morning the dapper and decorous ghem-Colonel **Benin** *of the Celestial Garden's own security arrives at the embassy. He has been assigned to investigate the supposed suicide of the Ba Lura. Miles quickly realizes that the subtle Benin is also thinking of murder, and that his investigation, if successful, must lead eventually back to the same satrap governor Miles is so anxious to identify and thwart. Miles is strategically vague about his conversation with the haut Rian, but posits the hautlady bubbles as a method of transport for a murderer and his victim. Benin is already aware of the possibility, and because of the high security of the bubbles, its implication—that someone over Benin's head in his own Security may have a hand in the murder, making any other verdict than confirming the suicide very dangerous to Benin's career. Miles also draws Benin's attention to the Ba Lura's movements in the days before its death, hoping thus to help target the satrap governor. Miles then suggests Benin make personal contact with the Cetagandan emperor, to request protection for his investigation against any attempt to quash it. Miles and Benin part warily pleased with each other. Ivan is cheered to receive a*

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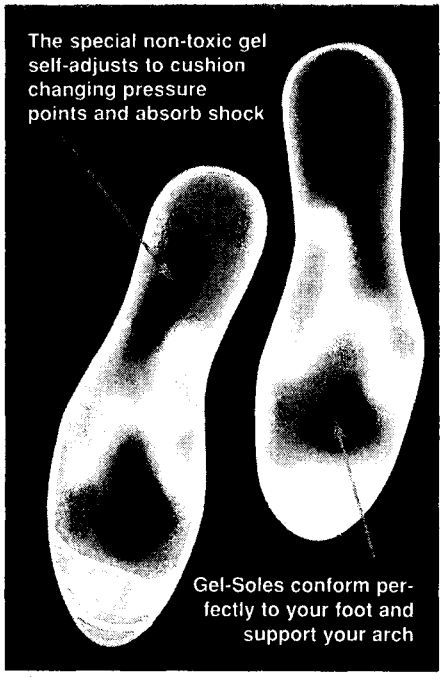
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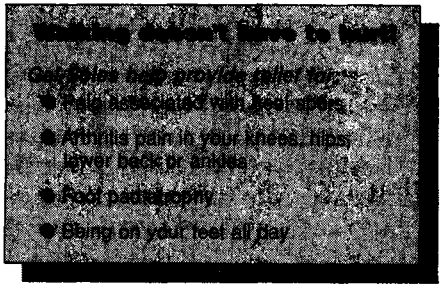
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flood of social invitations from his new ghem-lady friends.

Miles returns to the Celestial Garden to attend the readings of elegiac poetry for the dead empress, in order to get a personal look at his eight satrap-governor suspects. The governors are trailed by eight white bubbles that, Maz informs Miles, contain their Consorts—not wives, but women independently appointed by the Empress to oversee the Star Crèche's business on each of the satrapies. Miles realizes his eight suspects have just become sixteen. Miles also gets his first look at the emperor, the haut **Fletchir Giaja**.

At a reception following the poetry readings, Miles tries to stir up some response by mentioning Yenaro to three of his top suspects, governors the haut **Este Rond,** *one of Barrayar's neighbors, the haut* **Ilsum Kety** *of distant Sigma Ceta, and the haut Prince* **Slyke Giaja,** *half-brother of the emperor. He also meets the beautiful haut* **Vio,** *wife of Kety's ghem-general* **Chilian,** *who by her marriage has lost the haut-lady privilege of the force bubble.*

His investigations are interrupted by the arrival of Rian's little ba servitor, who delivers Miles to the Star Crèche itself, a surprisingly utilitarian building in the heart of the Celestial Garden. Inside, Rian tells him she has been paid a visit by Prince Slyke, ostensibly for a tour, actually to request a view of the Empress's Regalia, including the false Key. Miles suggests a covert visit to Slyke's state ship, in orbit, to search for the real Key.

Miles emerges from the Star Crèche to find the dryly frustrated ghem-Colonel Benin, excluded from monitoring inside the Star Crèche, waiting. Benin escorts the Barrayarans rather firmly to the exit; fortunately, this is no place for two Security officers from rival empires to sit down and compare notes.

PART THREE

CHAPTER TEN

"You've got to help me out on this one, Ivan," Miles whispered urgently.

"Oh?" murmured Ivan, in a tone of extreme neutrality.

"I didn't know Vorob'yev would be sending *him* along." Miles jerked his chin toward Lord Vorreedi, who had stepped away for some under-voiced conference of his own with their groundcar's driver, the uniformed embassy guard, and the plainclothes guard. The uniformed man wore undress greens like Miles and Ivan; the other two wore the body suits and calf-length robes of Cetagandan street wear, the protocol officer with more comfortable practiced ease.

Miles continued, "When I set up this rendezvous with my contact, I thought we'd get Mia Maz as our native guide again, what with this exhibition being the Ladies' Division or whatever they call it. You won't just need to cover my departure. You may need to distract them, when I make my break."

The plainclothes guard nodded and strode off. Outer-perimeter man; Miles memorized his face and clothing. One more thing to keep track of. The guard headed toward the entrance to the exhibition . . . hall, it was not. When today's outing had first been described to

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Miles, he had pictured some cavernous quadrangular structure like the one that housed the District Agricultural Fair at Hassadar. Instead the Moon Garden Hall, as it was styled, was another dome, a miniature suburban imitation of the Celestial Garden at the center of the city. Not too miniature—it was over three hundred meters in diameter, arcing over steeply sloping ground. Flocks of well-dressed ghem-types, both men and women, funneled toward its upper entrance.

"How the hell am I supposed to do that, coz? Vorreedi's not the distractible sort."

"Tell him I left with a lady, for . . . immoral purposes. You leave with immoral ladies all the time, why not me?" Miles's lips twisted in a suppressed snarl at Ivan's rolled eyes. "Introduce him to half a dozen of *your* girlfriends, I can't believe we won't run across some here. Tell them he's the man who taught you all you know about the Barrayaran Art of Love."

"He's not my type," said Ivan through his teeth.

"So use your initiative!"

"I don't have initiative. *I* follow orders, thank you. It's much safer."

"Fine. I *order* you to use your initiative."

Ivan breathed a bad word, by way of editorial. "I'm going to regret this, I know I am."

"Just hold on a little while longer. This will all be over in a few hours." *One way or another.*

"*That's* what you said day before yesterday. You lied."

"It wasn't my fault. Things were a little more complicated than I'd anticipated."

"You remember the time down at Vorkosigan Surleau when we found that old guerrilla weapons cache, and you talked me and Elena into helping you activate the old hovertank? And we ran it into the barn? And the barn collapsed? And my mother put me under house-arrest for two months?"

"We were ten years *old,* Ivan!"

"I remember it like yesterday. I remember it like day-before-yesterday, too."

"That old shed was practically falling down anyway. Saved the price of a demolition crew. For God's sake Ivan, this is serious! You can't compare it to—" Miles broke off as the protocol officer dismissed his men and, smiling faintly, turned back to the two young envoys. He shepherded them into the Moon Garden Hall.

Miles was surprised to see something so crass as a sign, even if made entirely of flowers, decorating an entry arch to a labyrinth of descending walkways spilling down the natural slope. *The 149th Annual Bioesthetics Exhibition, Class A. Dedicated to the Memory of the Celestial Lady*. Which dedication had made it a mandatory stop on all polite funeral envoys' social calendars. "Do the haut-women compete here?" Miles asked the protocol officer. "I'd think this would be in their style."

"So much so that no one else could win if they did," said Lord Vorreedi. "They have their own annual bash, very privately, inside the Celestial Garden, but it's on hold till this period of official mourning is completed."

"So . . . these ghem-women ex-

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hibitors are, um, imitating their haut half-sisters?"

"Trying to, anyway. That's the name of the game, here."

The ghem-ladies' exhibits were arranged not in rows, but each set individually in its own curve or corner. Miles wondered briefly what kind of jockeying went on behind the scenes for favorable sites and spaces, and what kind of status-points one could win for obtaining the best ones, and if the competition went as far as assassinations. Character-assassinations, anyway, he judged from a few snatches of conversation from groups of ghem-ladies strolling about, admiring and critiquing.

A large tank of fish caught his eye. They were filmy-finned, their iridescent scales colored in the exact pattern of one of the ghem-clan's face paintings: bright blue, yellow, black and white. The fish swirled in a watery gavotte. It was not too remarkable, genetic-engineering-wise, except that the proud and hopeful exhibitor hovering nearby appeared to be a girl of about twelve. She seemed to be a mascot for her clan's ladies' more serious exhibits. *Give me six years, and watch out!* her small smile seemed to say.

Blue roses and black orchids were so routine, they were used merely as framing borders for the real entries. A young girl passed by, in tow of her ghem-parents, with a unicorn about half a meter high scampering after her on a golden leash. It wasn't even an exhibit, maybe a commercial product, for all Miles knew. Unlike Hassadar's District Agricultural Fair, utility did not seem to be a consideration. It might even count as a defect. The competition was for art; life was merely the medium, a bio-palette supplying effects.

They paused to lean on a balcony railing that gave a partial over-view down the hanging garden's slopes. A green flicker by his feet caught Miles's eye. An array of glossy leaves and tendrils was spiraling up Ivan's leg. Red blossoms slowly opened and closed, breathing a deep and delicate perfume, albeit the total effect was unfortunately mouth-like. He stared in fascination for a full minute before murmuring, "Uh, Ivan . . . ? Don't move. But look at your left boot."

As Miles watched, another tendril slowly wrapped itself around Ivan's knee and began hoisting. Ivan glanced down, lurched, and swore. "What the hell *is* it? Get it off me!"

"I doubt it's poisonous," said the protocol officer uncertainly. "But perhaps you had better hold still."

"I . . . think it's a climbing rose. Lively little thing, isn't it?" Miles grinned, and bent nearer, cautiously checking for thorns before extending his hands. They might be retractable or something. Colonel Vorreedi made a hesitant restraining motion.

But before he mustered the nerve to risk skin and flesh, a plump ghem-lady carrying a large basket hurried up the path. "Oh, there you are, you bad thing!" she cried. "Excuse me, sir," she addressed Ivan without looking up, kneeling by his boot and commencing to unwind her quarry. "Too much nitrogen this morning, I'm afraid."

The rose let go its last tendril from around Ivan's boot with a regretful re-

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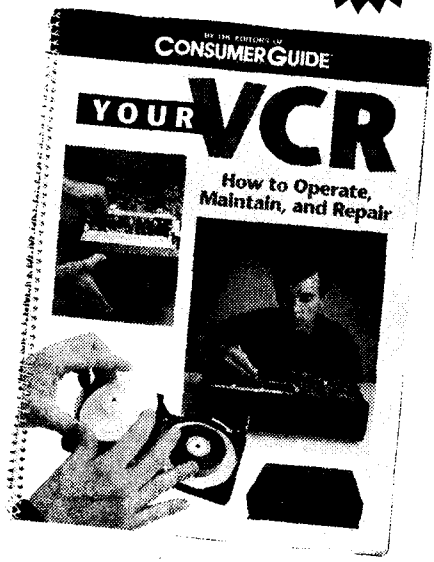

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coil, and was unceremoniously plunged into the basket with some other writhing escapees, pink and white and yellow. The woman, her eyes darting here and there at corners and under benches, hurried on.

"I think it liked you," said Miles to Ivan. "Pheromones?"

"Get stuffed," murmured Ivan back. "Or I'll dip *you* in nitrogen, and stake you out under the—good God, what is this?"

They'd rounded a corner to an open area displaying a graceful tree, with large fuzzy heart-shaped leaves filling two or three dozen branches that arced and drooped again, swaying slightly with the burden of the podded fruit tipping each branch. The fruit was mewing. Miles and Ivan stepped closer.

"Now . . . now *that* is just plain *wrong,*" said Ivan indignantly.

Bundled upside down in each fruit pod was a small kitten, long and silky white fur fluffing out around each feline face, framing ears and whiskers and bright blue eyes. Ivan cradled one in his hand, and lifted it to his face for closer examination. With one blunt finger he carefully tried to pet the creature; it batted playfully at his hand with soft white front paws.

"Kittens like this should be out chasing string, not glued into damned *trees* to score points for some ghem-bitch," Ivan opined hotly. He glanced around the area; they were temporarily alone and unobserved.

"Um . . . I'm not so sure they're glued in," said Miles. "Wait, I don't think you'd better—"

Trying to stop Ivan from rescuing a kitten from a tree was approximately as futile as trying to stop Ivan from making a pass at a pretty woman. It was some kind of spinal reflex. By the glint in his eye, he was bent on releasing all the tiny victims, to chase after the climbing roses perhaps.

Ivan snapped the pod from the end of its branch. The kitten emitted a squall, convulsed, and went still.

"Kitty, kitty . . . ?" Ivan whispered doubtfully into his cupped hand. An alarming trickle of red fluid coursed from the broken stem across his wrist.

Miles pulled back the pod-leaves around the kitten's . . . corpse, he feared. There was no back half to the beast. Pink naked legs fused together and disappeared into the stem part of the pod.

"I don't think it was ripe, Ivan."

"That's *horrible!*" Ivan's breath rasped in his throat with his outrage, but the volume was pitched way down. By unspoken mutual consent, they sidled quickly away from the kitten-tree and around the nearest unpeopled corner. Ivan glanced around frantically for a place to dispose of the tiny corpse, and so distance himself from his sin and vandalism. "Grotesque!"

Miles said thoughtfully, "Oh, I don't know. It's not any more grotesque than the original method, when you think about it. I mean, have you ever watched a mother cat give birth to kittens?"

Ivan covered his full hand with the other, and glared at his cousin. The protocol officer studied Ivan's dismay with a mixture of exasperation and sympathy. Miles thought that if he had known Ivan longer, the proportion of

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the first emotion to the second would be much higher, but Vorreedi only said, "My lord . . . would you like me to dispose of that for you . . . discreetly?"

"Uh, yes, please," said Ivan, looking very relieved. "If you don't mind." He hastily palmed off the inert pod of fluff onto the protocol officer, who hid it in a pocket handkerchief.

"Stay here. I'll be back shortly," he said, and went off to get rid of the evidence.

"Good one, Ivan," growled Miles. "Want to keep your hands in your pockets after this?"

Ivan scrubbed at the sticky substance on his hand with his own handkerchief, spat into his palm, and scrubbed again. *Out, out, damned spot.* . . . "Don't you start making noises like my mother. It wasn't my fault. Things were a little more complicated than I'd anticipated." Ivan stuffed his handkerchief back in his pocket, and stared around, frowning. "This isn't fun any more. I want to go back to the embassy."

"You have to hang on till I meet my contact, at least."

"And when will that be?"

"Soon, I suspect."

They strolled to the end of the aisle, where another little balcony gave an enticing view of the next lower section.

"Damn," said Ivan.

"What do you see?" asked Miles, tracking his gaze. He stretched to stand on tiptoe, but it wasn't enough to spot what had caught Ivan's negative attention.

"Our good buddy Lord Yenaro is here. Two levels down, talking to some women."

"It . . . could be a coincidence. This place is lousy with ghem-lords, with the award ceremony this afternoon. The winning women gain honor for their clan, naturally they want to cash in. And this is just the sort of artsy stuff that tickles his fancy, I think."

Ivan cocked an eyebrow at him. "You want to bet on that?"

"Nope."

Ivan sighed. "I don't suppose there's any way we can get him before he gets us."

"Don't know. Keep your eyes open, anyway."

"No lie."

They stared around some more. A ghem-lady of middle-age and dignified bearing approached them, and gave Miles an acknowledging, if not exactly friendly, nod. Her palm turned outward briefly, displaying to him a heavy ring, with a raised screaming-bird pattern filigreed with complex encodes.

"Now?" Miles said quietly.

"No." Her cultured voice was a low-pitched alto. "Meet me by the west entrance in thirty minutes."

"I may not be able to achieve precision."

"I'll wait." She passed on.

"Crap," said Ivan, after a moment's silence. "You're really going to try to bring this off. You will be the hell careful, won't you?"

"Oh, yes."

The protocol officer was taking a long time to find the nearest waste-disposal unit, Miles thought. But just as his nerves were stretching to the point of going to look for the man, he reap-

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peared, walking quickly toward them. His smile of greeting seemed a little strained.

"My lords," he nodded. "Something has come up. I'm going to have to leave you for a while. Stay together, and don't leave the building, please."

Perfect. Maybe. "What sort of something?" asked Miles. "We spotted Yenaro."

"Our practical joker? Yes. We know he's here. My analysts judge him a nonlethal annoyance. I must leave you to defend yourselves from him, temporarily. But my outer-perimeter man, who is one of my sharpest fellows, has spotted another individual, known to us. A professional."

The term *professional,* in this context, meant a professional killer, or something along those lines. Miles nodded alertly.

"We don't know why he's here," Vorreedi went on. "I have some heavier backup on the way. In the meanwhile, we propose to . . . drop in on him for a short chat."

"Fast-penta is illegal here for anyone but the police and the imperials, isn't it?"

"I doubt this one would go to the authorities to complain," murmured Vorreedi, with a slightly sinister smile.

"Have fun."

"Watch yourselves." The protocol officer nodded, and drifted away, as-if-casually.

Miles and Ivan walked on, pausing to examine a couple more rooted floral displays that seemed less unnervingly uncertain of their kingdom and phylum. Miles counted minutes in his head. He could break away shortly, and reach his rendezvous right on time. . . .

"Well, *hello*, sweet thing," a musical voice trilled from behind them. Ivan turned around a beat faster than Miles. Lady Arvin and Lady Benello stood with arms linked. They unlinked arms and . . . oozed, Miles decided was the term, up on either side of Ivan, capturing one side each.

"Sweet thing?" Miles murmured in delight. Ivan spared him a brief glower before turning to his greeters.

"We heard you were here, Lord Ivan," the blonde, Lady Arvin, continued. Tall Lady Benello concurred, her cascade of auburn curls bouncing with her nod. "What are you doing afterwards?"

"Ah . . . no particular plans," said Ivan, his head swiveling in an attempt to divide his attention precisely in half.

"Ooh," said Lady Arvin. "Perhaps you would care to have dinner with me, at my penthouse."

Lady Benello interrupted, "Or, if you're not in an urban mood, I know this place not far from here, on a lake. Each patron is rowed out to his own little tiny island, and a picnic is served, *al fresco*. It's *very* private."

Each woman smiled repellingly at the other. Ivan looked faintly hunted. "What a tough decision," he temporized.

"Come along and see Lady Benello's sister's pretties, while you think about it then, Lord Ivan," said Lady Arvin equably. Her eye fell on Miles. "You too, Lord Vorkosigan. We've been neglecting our most senior guest quite shamefully, *I* think. Upon discussion, we think this might be a regrettable oversight." Her hand tightened on

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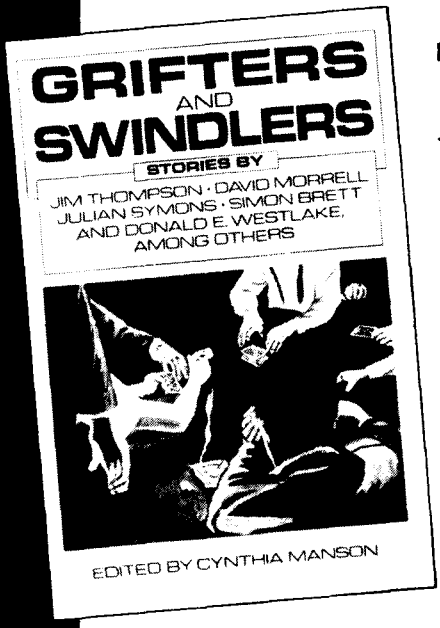

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Ivan's arm, and she peeked around his torso to give her red-haired companion a bright, meaningful smile. "This could be the solution to Lord Ivan's dilemma."

"In the dark all cats are gray?" Miles murmured. "Or at any rate, all Barrayarans?"

Ivan winced at the mention of felines. Lady Arvin looked blank, but Miles had a bad feeling the redhead had caught the joke. In any case, she detached herself from Ivan—was that a flash of triumph, crossing Lady Arvin's face?—and turned to Miles.

"Indeed, Lord Vorkosigan. Do you have any particular plans?"

"I'm afraid so," said Miles with a regret that was not entirely feigned. "In fact, I have to be going now."

"Right now? Oh, do come . . . see my sister's exhibit, at least." Lady Benello stopped short of linking arms with him, but seemed willing to walk by his side, even if it left her rival in temporary possession of Ivan.

Time. It wouldn't hurt to give the protocol officer a few more minutes to become fully engaged with his quarry. Miles smiled thinly, and allowed himself to be dragged along in the wake of the party, Lady Arvin in the lead towing Ivan. That tall red-head lacked the porcelain delicacy of the haut Rian. On the other hand, she was not nearly so . . . *impossible. The difficult we do at once. The impossible takes. . . .*

Stop it. These women are users, you know that.

Oh, God, let me be used. . . .

Focus, boy, goddammit.

They walked down the switchback pathway, arriving at the next lower level. Lady Arvin turned in at a small circular open space screened by trees in tubs. Their leaves were glossy and jewel-like, but they were merely a frame for the display in the center. The display was a little baffling, artistically. It seemed to consist of three lengths of thick brocade, in subtle hues, spiraling loosely around each other from the top of a man-high pole to trail on the carpet below. The dense circular carpet echoed the greens of the bordering trees, in a complex abstract pattern.

"Heads up," murmured Ivan.

"I see him," breathed Miles.

Lord Yenaro, dark-robed and smiling, was sitting on one of the little curving benches that also helped frame the space.

"Where's Veda?" asked Lady Benello.

"She just stepped out," said Yenaro, rising and nodding greetings to all.

"Lord Yenaro has been giving my sister Veda a little help with her entry," Lady Benello confided to Miles and Ivan.

"Oh?" said Miles, staring around and wondering where the trap was this time. He didn't see it yet. "And, uh . . . just what is her entry?"

"I know it doesn't look very impressive," said Lady Benello defensively, "but that's not the point. The subtlety is in the smell. It's the cloth. It emits a perfume that changes with the mood of the wearer. I *still* wonder if we ought to have had it made up into a dress," this last comment seemed aimed at Yenaro. "We could have had one of the servitors stand here and model it all day."

"It would have seemed too commercial," Yenaro said to her. "This will

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score better."

"And, um . . . it's alive?" asked Ivan doubtfully.

"The scent glands in the cloth are as alive as the sweat glands in your body," Yenaro assured him. "Nevertheless, you are right, the display is a bit static. Step closer, and we'll hand-demonstrate the effects."

Miles sniffed, his paranoia-heightened awareness trying to individually check every volatile molecule that entered his nostrils. The dome was clouded with scents of every kind, drifting down from the displays up-slope, not to mention the perfumes of the ghem-ladies and Yenaro in their robes. But the brocade did seem to be emitting a pleasant mixture of odors. Ivan didn't respond to the invitation to come closer either, Miles noticed. In addition to the perfumes, though, there was something else, a faint, oily acridity. . . .

Yenaro picked up a pitcher from the bench and walked toward the pole. "More zlati ale?" Ivan murmured dryly.

Recognition and memory zinged through Miles, followed by a wave of adrenaline that nearly stopped his heart before it began racing. "Grab that pitcher, Ivan! Don't let him spill it!"

Ivan did. Yenaro gave up his hold with a surprised snort. "Really, Lord Ivan!"

Miles dropped prone to the thick carpet, sniffing frantically. *Yes.*

"What are you *doing?*" asked Lady Benello, half-laughing. "The rug isn't part of it!"

Oh, yes it is. "Ivan," said Miles urgently, scrambling back to his feet. "Hand me that—*carefully*—and tell me what you smell down there."

Miles took the pitcher much more tenderly than he would have a basket of raw eggs. Ivan, with a look of some bewilderment, did as he was told. He sniffed, then ran his hand through the carpet, and touched his fingers to his lips. And turned white. Miles knew Ivan had reached the same conclusion he had even before he turned his head and hissed, "Asterzine!"

Miles tiptoed back well away from the carpet, lifted the pitcher's lid, and sniffed again. A faint odor resembling vanilla and oranges, gone slightly wrong, wafted up, which was exactly right.

And Yenaro had been going to dump it all, Miles was sure. At his own feet. With Lady Benello and Lady Arvin looking on. Miles thought of the fate of Lord X's, Prince Slyke's, last tool, the Ba Lura. *No. Yenaro doesn't know. He may hate Barrayarans, but he's not that frigging crazy. He was set up right along with us, this time. Third time's a charm, all right.*

When Ivan rose, his jaw set and his eyes burning, Miles motioned him over and handed him the pitcher again. Ivan took it gingerly, stepping back another pace. Miles knelt and tore off a few threads from the carpet's edge. The threads parted with a gum-like stretching, confirming his diagnosis. "Lord Vorkosigan!" Lady Arvin objected, her brows drawn down in amused puzzlement at the Barrayarans's bizarre barbarian behavior.

Miles traded the threads to Ivan for the pitcher again, and jerked his head toward Yenaro. "Bring *him*. Excuse us, please, ladies. Um . . . man-talk."

Rather to his surprise, this appeal ac-

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tually worked; Lady Arvin only arched her brows, though Lady Benello pouted slightly. Ivan wrapped one hand around Yenaro's upper arm, and guided him out of the display area. Ivan's grip tightened in silent threat when Yenaro tried to shrug him off. Yenaro looked angry and tight-lipped, and just a little embarrassed.

They found an empty nook a few spaces down. Ivan stood himself and his captive with their backs to the path, shielding Miles from view. Miles gently set the pitcher down, stood, jerked up his chin, and addressed Yenaro in a low-pitched growl. "I will demonstrate what you almost did in just a moment. What I want to know now is just what the hell you *thought* you were doing?"

"I don't know what you're talking about," snapped Yenaro. "Let *go,* you lout!"

Ivan kept his hold, frowning fiercely. "Demonstrate first, coz."

"Right." The paving-stones were some cool artificial marble, and did not look flammable. Miles shook the threads off his finger, and motioned Ivan and Yenaro closer. He waited till there were no passersby in sight and said, "Yenaro. Take two drops on your fingers of that harmless liquid you were waving around, and sprinkle them on this."

Ivan forced Yenaro to kneel alongside Miles. Yenaro, with a cold glance at his captors, dipped his hand and sprinkled as ordered. "If you think —"

He was interrupted by a bright flash and a wave of heat that scorched Miles's eyebrows. The soft report, fortunately, was mostly muffled by their shielding bodies. Yenaro froze, arrested.

"And that was only about a gram of material," Miles went on relentlessly. "That whole carpet-bomb massed, what, about five kilos? You should know, I'm certain you carried it in here personally. When the catalyst hit, it would have gone up taking out this whole section of the dome, you, me, the ladies. It would have been quite the high point of the show."

"This is some sort of trick," grated Yenaro.

"Oh, it's a trick all right. But this time the joke was on you. You've never had any military training at all, have you? Or with your nose, you'd have recognized it too. Sensitized asterzine. Lovely stuff. Formable, dyeable, you can make it look like practically anything. And totally inert and harmless, till the catalyst hits it. Then. . . ." Miles nodded toward the small scorched patch on the white pavement. "Let me put the question to you another way, Yenaro. What effect did your good friend the haut-governor *tell* you this was going to have?"

"He—" Yenaro's breath caught. His hand swept down across the dark and oily residue, then rose to his nose. He inhaled, frowning, then sat back rather weakly on his heels. His wide eyes lifted to meet Miles's gaze. "Oh."

"Confession," said Ivan meaningfully, "is good for the soul. And body."

Miles took a breath. "Once more, from the top, Yenaro. What did you *think* you were doing?"

Yenaro swallowed. "It . . . was supposed to release an ester. That would simulate alcohol poisoning. You Barra-

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yarans are famous for that perversion. Nothing that you don't already do to yourselves!"

"Allowing Ivan and me to publicly stagger through the rest of the afternoon blind drunk, or a close approximation."

"Something like that."

"And yourself? Did you just ingest the antidote, before we showed up?"

"No, it was harmless! Supposed to be. I had made arrangements to go and rest, till it passed off. I thought it might be . . . an interesting sensation."

"Pervert," murmured Ivan.

Yenaro glared at him.

Miles said slowly, "When I was burned, that first night. All that hand-wringing on your part wasn't totally feigned, was it? You weren't expecting it."

Yenaro paled. "I expected . . . I thought perhaps the Marilacans had done something to the power adjustment. It was only supposed to shock, not injure."

"Or so you were told."

"Yes," Yenaro whispered.

"The zlati ale was your idea, though, wasn't it?" growled Ivan.

"You knew?!"

"I'm not an idiot."

Some passing ghem glanced in puzzlement at the three men kneeling in a circle on the floor, though fortunately they passed on without comment. Miles nodded to the nearest bench, in the curve of the nook. "I have something to tell you, Lord Yenaro, and I think you had better be sitting down." Ivan guided Yenaro to it and firmly pushed him down. After a thoughtful moment, Ivan then poured the rest of the pitcher of liquid into the nearest tree-tub, before settling between Yenaro and the exit.

"This isn't just a series of gratifying tricks played on the doltish envoys of a despised enemy, for you to chuckle at," Miles went on lowly. "You are being used as a pawn in a treason plot against the Cetagandan Emperor. Used, discarded, and silenced. It's beginning to be a pattern. Your last fellow-pawn was the Ba Lura. I trust you've heard what happened to *it*."

Yenaro's pale lips parted, but he breathed no word. After a moment he licked his lips and tried again. "This can't be. It's too crude. It would have started a blood feud between his clan and those of . . . all the innocent bystanders."

"No. It would have started a blood feud between their clans and *yours*. You were set up to take the fall for this one. Not only as an assassin, but as one so incompetent that he blew himself up with his own bomb. Following in your grandfather's footsteps, so to speak. And who would be left alive to deny it? The confusion would multiply within the capital, as well as between your empire and Barrayar, while his satrapy made its break for independence. No, not crude. Downright elegant."

"The Ba Lura committed suicide. It was said."

"No. Murdered. Cetagandan Imperial Security is on to that one, too. They will unravel it in time. No . . . they will unravel it eventually. I don't trust that it will be in time."

"It is impossible for a ba servitor to commit treason."

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"Unless the ba servitor thinks that it is acting loyally, in a deliberately ambiguous situation. I don't think even the ba are so un-human that they cannot be *mistaken*."

"No." Yenaro looked up at both the Barrayarans. "You must believe, I would have no regrets whatsoever if you two fell off a cliff. But I would not push you myself."

"I . . . so I judged," said Miles. "But for my curiosity—what were you to get out of the deal, besides a week's amusement in embarrassing a couple of loutish barbarians? Or was this art for art's sake on your part?"

"He promised me a post." Yenaro stared at the floor again. "You don't understand what it is to be without a post in the capital. You have no position. You have no status. You are . . . no one. I was tired of being no one."

"What post?"

"Imperial Perfumer." Yenaro's dark eyes flashed. "I know it doesn't sound very mighty, but it would have gained me entrance to the Celestial Garden, maybe the Imperial Presence itself. Where I would have worked among . . . the best in the empire. The top people. And I would have been *good*."

Miles had no trouble understanding ambition, no matter how arcane its form. "I imagine so."

Yenaro's lips twitched in half a grateful smile.

Miles glanced at his chrono. "God, I'm late. Ivan—can you handle this from here?"

"I think so."

Miles rose. "Good day, Lord Yenaro, and a better one than you were destined to have, I think. I may have used up a year's supply this afternoon already, but wish me luck. I have a little date with Prince Slyke now."

"Good luck," Yenaro said doubtfully.

Miles paused. "It *was* Prince Slyke, was it not?"

"No! I was talking about Governor the haut Ilsum Kety!"

Miles pursed his lips, and blew out his breath in a slow trickle. *I have just been either screwed or saved. I wonder which?* "Kety set you up . . . with all this?"

"Yes."

Could Kety have sent his fellow governor and cousin Prince Slyke to scout out the Imperial Regalia for him—a stalking horse? Certainly. Or not. For that matter, could Slyke have set up Kety to operate Yenaro for him? Not impossible. *Back to square one. Damn, damn, damn!*

While Miles hovered in new doubt, the protocol officer rounded the corner. His hurried stride slowed as he spotted Miles and Ivan, and a look of relief crossed his face. By the time he strolled into the nook he was projecting the air of a tourist again, but he raked Yenaro with a knife-keen glance.

"Hello, my lords," his nod took all three in equally.

"Hello, sir," said Miles. "Did you have an interesting conversation?"

"Extraordinarily."

"Ah . . . I don't believe you've formally met Lord Yenaro, sir. Lord Yenaro, this is my embassy's protocol officer, Lord Vorreedi."

The two men exchanged more studied nods, Yenaro's hand going to his chest in a sketch of a sitting bow.

"What a coincidence, Lord Yenaro,"

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Vorreedi went on. "We were just talking about you."

"Oh?" said Yenaro warily.

"Ah. . . ." Vorreedi sucked his lip thoughtfully, then seemed to come to some internal decision. "Are you aware that you seem to be in the middle of some sort of vendetta at present, Lord Yenaro?"

"I—no! What makes you think so?"

"Hm. Normally, ghem-lords' personal affairs are not my business, only the official ones. But the, ah, chance of a good deed has come up so squarely in my path, I shall not avoid it. This time. I just had a short talk with a, ah, gentleman who informed me he was here today with the mission of seeing that you, in his precise phrasing, did not leave the Moon Garden Hall alive. He was a little vague about what method he proposed to use to accomplish this. What made him peculiar in this venue was that he was no ghem. A purely commercial artist. He did not know who had hired him, that information being concealed behind several layers of screening. Do you have any guesses?"

Yenaro listened to this recital shocked, tight-lipped, and thoughtful. Miles wondered if Yenaro was going through the same set of deductions he was. He rather thought so. The haut-governor, it appeared, whichever one it was, had sent Yenaro's ploy some backup. Just to make sure nothing went wrong. Such as Yenaro surviving his own bombing to accuse his betrayer.

"I . . . have a guess, yes."

"Would you care to share it?"

Yenaro regarded him doubtfully. "Not at this time."

"Suit yourself," Vorreedi shrugged. "We left him sitting in a quiet corner. The fast-penta should wear off in about ten minutes. You have that much lead-time to do—whatever you decide."

"Thank you, Lord Vorreedi," said Yenaro quietly. He gathered his dark robes about himself, and rose. He was pale, but admirably controlled, not shaking. "I think I will leave you now."

"Probably a good choice," said Vorreedi.

"Keep in touch, huh?" said Miles.

Yenaro gave him a brief, formal nod. "Yes. We must talk again." He strode away, glancing left and right.

Ivan chewed on his fingers. It was better than his blurting out everything to Vorreedi right here and now, Miles's greatest fear.

"Was that all true, sir?" Miles asked Colonel Vorreedi.

"Yes." Vorreedi rubbed his nose. "Except that I'm not so certain that it isn't any of our business. Lord Yenaro seems to be taking a great deal of interest in you. One can't help wondering if there might be some hidden connection. Sifting through that hired thug's hierarchy would be tedious and time-consuming for my department. And what would we find at the end?" Vorreedi's eye fell coolly on Miles. "Just how angry *were* you at getting your legs burned the other night, Lord Vorkosigan?"

"Not that angry!" Miles denied hastily. "Give me credit for a sense of proportion, at least, sir! No. It wasn't me who hired the goon." Though he had just as surely set up Yenaro for this, by attempting to play all those cute little

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head-games with his possible patrons, Kety, Prince Slyke, and the Rond. *You wanted a reaction, you got one.* "But . . . it's just a feeling, you understand. But I think pursuing this lead might be time and resources well-spent."

"A feeling, eh?"

"You surely have trusted your intuition before, in your work, sir."

"Used, yes. Trusted, never. An ImpSec officer should be clear about the difference."

"I understand, sir."

They all rose to continue the tour of the exhibition, Miles carefully not glancing at the scorched spot on the pavement as they passed on. As they approached the west side of the dome, Miles searched the robed crowd for his contact-lady. There she was, sitting near a fountain, frowning. But he would never succeed in ditching Vorreedi now; the man was stuck like glue. He tried anyway. "Excuse me, sir. I have to speak to a lady."

"I'll come with you," said Vorreedi pleasantly.

Right. Miles sighed, hastily composing his message. The dignified ghem-lady looked up as he approached with his unwelcome companions. Miles realized he didn't know the woman's name.

"Pardon me, milady. I just wanted to let you know that I will not be able to accept your invitation to visit, uh, this afternoon. Please convey my deepest regrets to your mistress." Would she, and the haut Rian, interpret this as intended, as *Abort, abort abort?!* Miles could only pray so. "But if she can arrange instead a visit to the man's cousin, I think that would be most educational."

The woman's frown deepened. But she only said, "I will convey your words, Lord Vorkosigan."

Miles nodded farewell, mentally blessing her for avoiding the pitfall of any more complicated reply. When he looked back, she had already swept to her feet and was hurrying away.

CHAPTER ELEVEN

Miles had not entered the sacred confines of the Barrayaran embassy's ImpSec offices before, having stayed discreetly upstairs in the diplomatic corps' plusher territory. As he'd posited, it was on the second lowest basement level. A uniformed corporal ushered him past security scanners and into Colonel Vorreedi's office.

It was not as austere as Miles expected, being decorated all about with small examples of Cetagandan art objects, though the powered sculptures were all turned off this morning. Some might be mementos, but the rest suggested the so-called protocol officer was a collector of excellent taste, if limited means.

The man himself was seated at a desk cleared in utilitarian bareness. Vorreedi was dressed as usual in the underlayers and robes of a middle-ranking ghem-lord of painfully sober preferences, subdued blues and grays. Except for the lack of face paint, in a crowd of ghem Vorreedi would practically disappear, though behind a Barrayaran ImpSec comconsole desk the effect of the ensemble was a little startling.

Miles moistened his lips. "Good morning, sir. Ambassador Vorob'yev

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told me you wanted to see me."

"Yes, thank you, Lord Vorkosigan." Vorreedi's nod dismissed the corporal, who withdrew silently. The doors slid shut behind him with a heavy sealing sound. "Do sit down."

Miles slipped into the station chair across the desk from Vorreedi, and smiled in what he hoped seemed innocent good cheer. Vorreedi looked across at Miles with keen, undivided attention. Not good. Vorreedi was second in authority here only to Ambassador Vorob'yev, and like Vorob'yev, had been chosen as a top man for one of the most critical posts in the Barrayaran diplomatic corps. One might count on Vorreedi to be a very busy man, but never a stupid one. Miles wondered if Vorreedi's meditations this past night had been one half so busy as his own. Miles braced himself for an Illyanesque opening shot, such as *What the hell are you up to, Vorkosigan, trying to start a damned war single-handed?!*

Instead, Colonel Vorreedi favored him with a long, thoughtful stare, before observing mildly, "Lieutenant Lord Vorkosigan. You are an ImpSec courier officer, by assignment."

"Yes, sir. When I am on duty."

"An interesting breed of men. Utterly reliable and loyal. They go here, go there, deliver whatever is asked of them without question or comment. Or failure, short of intervention by death itself."

"It's not usually that dramatic. We spend a lot of time riding around in jumpships. One catches up on one's reading."

"Mm. And to a man, these glorified mailmen report to Commodore Boothe, head of ImpSec Communications, Komarr. With one exception." Vorreedi's gaze intensified. "*You* are listed as reporting directly to Simon Illyan himself. Who reports to Emperor Gregor. The only other person I know of offhand in a chain of command that short is the Chief of Staff of the Imperial Service. It's an interesting anomaly. How do you explain it?"

"How do *I* explain it?" Miles echoed, temporizing. He thought briefly of replying, *I never explain anything*, except that was both 1) already evident and 2) clearly not the answer Vorreedi was looking for. "Why . . . every once in a while Emperor Gregor needs a personal errand run for himself or his household which is too trivial, or too inappropriate, to assign to working military personnel. Perhaps he wants, say, an ornamental breadfruit bush brought from the planet Pol to be planted in the garden of the Imperial Residence. They send me."

"That's a good explanation," Vorreedi agreed blandly. There was a short silence. "And do you have an equally good story for how you acquired this pleasant job?"

"Nepotism, obviously. Since I am clearly," Miles's smile thinned, "physically unfit for normal duties, this post was manufactured for me by my family connections."

"Hm." Vorreedi sat back, and rubbed his chin. "Now," he said distantly, "if you were a covert ops agent here on a mission from God," meaning Simon Illyan—same thing, from the ImpSec point of view, "you should have arrived with some sort of *Render all due as-*

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sistance order. Then a poor ImpSec local man might know where he stood with you."

If I don't get this man under control, he can and will nail my boots to the floor of the embassy, and Lord X will have no impediment at all to his baroque bid for chaos and empire.

"Yes, sir," Miles took a breath, "and so would anyone else who saw it."

Vorreedi glanced up, startled. "Does ImpSec Command suspect a leak in my communications?"

"Not as far as I know. But as a lowly courier, I can't ask questions, can I?"

By the slight widening of his eyes, Vorreedi caught the joke. A subtle man indeed. "From the moment you set foot on Eta Ceta, Lord Vorkosigan, I have not noticed you *stop* asking questions."

"A personal failing."

"And . . . do you have any supporting evidence for your explanation of yourself?"

"Certainly." Miles stared thoughtfully into the air, as if about to pull his words from the thinnest part. "Consider, sir. All other ImpSec courier officers have an implanted allergy to fast-penta. It renders them interrogation-proof to illicit questioners, at fatal cost. Due to my rank and relations, that was judged too dangerous a procedure to do to me. Therefore, I am qualified for only the lowest-security sort of missions. It's all nepotism."

"Very . . . convincing."

"It wouldn't be much good if it weren't, sir."

"True." Another long pause. "Is there anything else you'd like to tell me—Lieutenant?"

"When I return to Barrayar, I will be giving a complete report of my—excursion to Simon Illyan. I'm afraid you'll have to apply to him. It is definitely not within my authority to try and guess what he will wish to tell you."

There, whew. He'd told no lies at all, technically, even by implication. *Yeah. Be sure and point that out when they play a transcript of this conversation at your future court martial.* But if Vorreedi chose to construe that Miles was a covert ops agent working on the highest levels and in uttermost secrecy, it was no less than perfectly true. The fact that his mission here was spontaneously self-appointed and not assigned from above was . . . another order of problem altogether.

"I . . . could add a philosophical observation."

"Please do, my lord."

"You don't hire a genius to solve the most intractable imaginable problem, and then hedge him around with a lot of rules, nor try to micromanage him from two weeks distance. You turn him loose. If all you need is somebody to follow orders, you can hire an idiot. In fact, an idiot would be better suited."

Vorreedi's fingers drummed lightly on his comconsole desk. Miles felt the man might have tackled an intractable problem or two himself, in his past. Vorreedi's brows rose. "And do you consider yourself a genius, Lord Vorkosigan?" he asked softly. Vorreedi's tone of voice made Miles's skin crawl, it reminded him so much of his father's when Count Vorkosigan was about to spring some major verbal trap.

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"My intelligence evaluations are in my personnel file, sir."

"I've read it. That's why we're having this conversation." Vorreedi blinked, slowly, like a lizard. "No rules at all?"

"Well, one rule, maybe. Deliver success or pay with your ass."

"You have held your current post for almost three years, I see, Lieutenant Vorkosigan. Your ass is still intact, is it?"

"Last time I checked, sir." *For the next five days, maybe.*

"This suggests astonishing authority and autonomy."

"No authority at all. Just responsibility."

"Oh, dear." Vorreedi pursed his lips very thoughtfully indeed. "You have my sympathy, Lord Vorkosigan."

"Thank you, sir. I need it." Into the all-too-meditative silence that followed Miles added, "Do we know if Lord Yenaro survived the night?"

"He disappeared, so we think he has. He was last seen leaving the Moon Garden Hall with a roll of carpet over his shoulder." Vorreedi cocked an inquiring eye at Miles. "I have no explanation for the carpet."

Miles ignored the broad hint, responding instead with, "Are you so sure that disappearance equates with his survival? What about his stalker?"

"Hm." Vorreedi smiled. "Shortly after we left him he was picked up by the Cetagandan Civil Police, who still have him in close custody."

"They did this on their own?"

"Let's say they received an anonymous tip. It seemed the socially responsible thing to do. But I must say, the Civils responded to it with admirable efficiency. He appears to be of interest to them for some previous work."

"Did he have time to report in to his employers, before he was canned?"

"No."

So, Lord X was in an information vacuum this morning. He wouldn't like that one bit. The misfire of yesterday's plot must make him frantically frustrated. He wouldn't know what had gone wrong, or if Yenaro had realized his intended fate, though Yenaro's disappearance and subsequent noncommunication would surely be a fat clue. Yenaro was now as loose a cannon as Miles and Ivan. Which of them would be first on Lord X's hit list after this? Would Yenaro go seeking protection to some authority, or would the rumor of treason frighten him off?

And what method could Lord X come up with for disposing of the Barrayaran envoys one-half so baroque and perfect as Yenaro had been? Yenaro was a masterpiece, as far as the art of assassination went, beautifully choreographed in three movements and a crescendo. Now all that elaborate effort was wasted. Lord X would be as livid at the spoiling of his lovely pattern as at the failure of his plot, Miles swore. And he was an anxious impatient artist who couldn't leave well enough alone, who had to add those clever little touches. The kind of person who, as a child given his first garden, would dig up the seeds to see if they'd sprouted yet. (Miles felt a tiny twinge of sympathy for Lord X.) Yes, indeed, Lord X, playing for great stakes and losing both time and his inhibitions, was now well and classically primed to make a major mistake.

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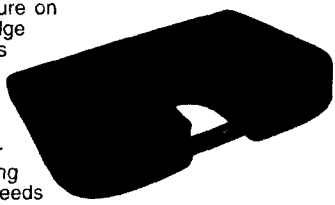

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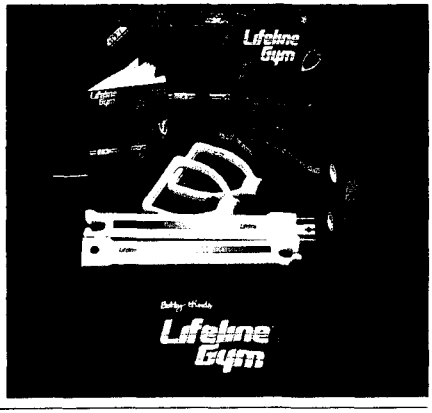

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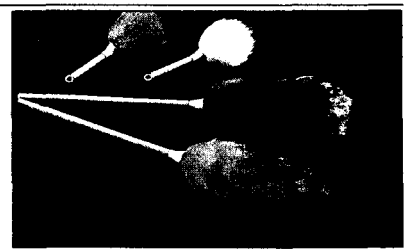

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Why am I not so sure that's such a great idea?

"More to add, Lord Vorkosigan?" said Vorreedi.

"Hm? No. Just, uh, thinking." *Besides, it would only upset you.*

"I would request, as the embassy officer ultimately responsible for your personal safety as an official envoy, that you and Lord Vorpatril end your social contacts with a man who is apparently involved in a lethal Cetagandan vendetta."

"Yenaro is of no further interest to me. I wish him no harm. My real priority is in identifying the man who supplied him with that fountain."

Vorreedi's brows rose in mild reproach. "You might have said so earlier."

"Hindsight," said Miles, "is always better."

"That's for damned sure," sighed Vorreedi, in a voice of experience. He scratched his nose, and sat back. "There is another reason I called you here this morning, Lord Vorkosigan. Ghem-Colonel Benin has requested a second interview with you."

"Has he? Same as before?" Miles kept his voice from squeaking.

"Not quite. He specifically requested to speak with both you and Lord Vorpatril. In fact, he's on his way now. But you can refuse the interview if you wish."

"No, that's . . . that's fine. In fact, I'd like to talk to Benin again. I, ah . . . shall I go fetch Ivan, then, sir?" Miles rose to his feet. Bad, bad idea to let the two suspects consult before the interrogation, but then, this wasn't Vorreedi's case. How fully had Miles convinced the man of his secret clout?

"Go ahead," said Vorreedi affably. "Though I must say. . . ."

Miles paused.

"I do not see how Lord Vorpatril fits into this. He's no courier officer. And his records are as transparent as glass."

"A lot of people are baffled by Ivan, sir. But . . . sometimes, even a genius needs someone who can follow orders."

Miles tried not to scamper, hustling down the corridor to Ivan's quarters. The luxury of privacy their status had bought them was about to come to a screeching halt, he suspected. If Vorreedi didn't turn on the bugs in both their rooms after this, the man either had supernatural self-control or was brain dead. And the protocol officer was the voraciously curious type; it went with his job.

Ivan unlocked his door with a drawl of "Enter," at Miles's impatient knock. Miles found his cousin sitting up in bed, half-dressed in green trousers and cream shirt, leafing through a pile of hand-calligraphed colored papers with an abstracted and not particularly happy air.

"Ivan. Get up. Get dressed. We're about to have an interview with Colonel Vorreedi and ghem-Colonel Benin."

"Confession at last, thank God!" Ivan tossed the papers up in the air and fell backward on his bed with a *woof* of relief.

"No. Not exactly. But I need you to let me do most of the talking, and confirm whatever I assert."

"Oh, damn." Ivan frowned up at the

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ceiling. "What *now?*"

"Benin has to have been investigating Ba Lura's movements, the day before its death. I'm guessing he's traced the Ba to our little encounter at the pod dock. I don't want to screw up his investigation. In fact, I want it to succeed, at least as far as identifying the Ba's murderer. So he needs as many real facts as possible."

"Real facts. As opposed to what other kind of facts?"

"We absolutely can't bring up any mention of the Great Key, or the haut Rian. I figure we can tell events exactly as they happened, just leave out that one tiny detail."

"You figure, do you? You must be using a different kind of math than the rest of the Universe. Do you realize how pissed Vorreedi and the Ambassador are going to be about our concealing that little incident?"

"I've got Vorreedi under control, temporarily. He thinks I'm on a mission from Simon Illyan."

"That means you aren't. I knew it!" Ivan groaned, and pulled a pillow over his face, and squashed it tight.

Miles pulled it out of his grasp. "I am now. Or I would be, if Illyan knew what I know. Bring that nerve disruptor. But don't pull it out unless I tell you to."

"I am not shooting your commanding officer for you."

"You're not shooting anybody. And anyway, Vorreedi's not my commander." That could be an important legal point, later. "I may want it for evidence. But not unless the subject comes up. We volunteer nothing."

"Never volunteer, yes, that's the ticket! You're catching on at last, coz!"

"Shut up. Get up." Miles threw Ivan's undress uniform jacket across his prostrate form. "This is important! But you have to stay absolutely cool. I may be completely off-base, and panicking prematurely."

"I don't think so. I think you're panicking post-maturely. In fact, if you were panicking any later it would be practically posthumously. I've been panicking for *days*."

Miles tossed Ivan his half-boots with ruthless finality. Ivan shook his head, sat up, and began pulling them on.

"Do you remember," Ivan sighed, "that time in the back garden at Vorkosigan House, when you'd been reading all those military histories about the Cetagandan prison camps during the invasion, and you decided we had to dig an escape tunnel? Except it was you who did all the designing, and me and Elena who did all the digging?"

"We were about eight," said Miles defensively. "The medics were still working on my bones. I was still pretty friable then."

"—And the tunnel collapsed on me?" Ivan went on dreamily. "And I was under there for *hours?*"

"It wasn't hours. It was minutes. Sergeant Bothari had you out of there in practically no time."

"It seemed like hours to *me*. I can still taste the dirt. It got stuffed up my nose, too." Ivan rubbed his nose in memory. "Mother would still be having the fit, if Aunt Cordelia hadn't sat on her."

"We were stupid little ***kids***. What has this got to do with anything?"

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"Nothing, I suppose. I just woke up thinking about it, this morning." Ivan stood up, fastened his tunic, and pulled it straight. "I never believed I'd miss Sergeant Bothari, but I think I do now. Who's going to dig me out this time?"

Miles wanted to snap out a sharp rejoinder, but shivered instead. *I miss Bothari, too.* He had almost forgotten how much, till Ivan's words hit the scar of his regret, that secret little pocket of anguish that never seemed to drain. Major mistakes. . . . Dammit, a man walking a tight-wire didn't need someone shouting from the sidelines how far down the drop was, or what lousy balance he had. It wasn't like he didn't know; but what he most needed was to forget. Even a momentary loss of concentration—of self-confidence—of forward momentum, could be fatal. "Do me a favor, Ivan. Don't try to think. You'll hurt yourself. Just follow orders, huh?"

Ivan bared his teeth in a non-smile, and followed Miles out the door.

They met with ghem-Colonel Benin in the same little conference room as before, but this time, Vorreedi rode shotgun personally, dispensing with the guard. The two colonels were just finishing the amenities and sitting down as Miles and Ivan entered, by which sign Miles hoped they'd had less time to compare notes than he and Ivan'd had. Benin was dressed again in his formal red uniform and lurid face-paint, freshly and perfectly applied. By the time they'd all finished going through the polite greetings once more, and everyone was re-seated, Miles had his breathing and heartbeat under control. Ivan concealed his nerves in an expression of blank benevolence that made him look, in Miles's opinion, remarkably sappy.

"Lord Vorkosigan," ghem-Colonel Benin began. "I understand you work as a courier officer."

"When I'm on duty." Miles decided to repeat the party line for Benin's benefit. "It's an honorable task, that's not too physically demanding for me."

"And do you like your duties?"

Miles shrugged. "I like the travel. And; ah . . . it gets me out of the way, an advantage that cuts two ways. You know about Barrayar's backward attitude to mutations." Miles thought of Yenaro's longing for a post. "And it gives me an official position, makes me somebody."

"I can understand *that,*" conceded Benin.

Yeah, I thought you would.

"But you're not on courier duty now?"

"Not this trip. We were to give our diplomatic duties our undivided attention, and, it was hoped, maybe acquire a little polish."

"And Lord Vorpatril here is assigned to Operations, is that right?"

"Desk work," Ivan sighed. "I keep hoping for ship duty."

Not really true, Miles reflected; Ivan adored being assigned to HQ at the capital, where he kept up his own apartment and a social life that was the envy of his brother-officers. Ivan just wished his mother *Lady* Vorpatril might be assigned ship duty, someplace far away.

"Hm." Benin's hands twitched, as if in memory of sorting stacks of plastic

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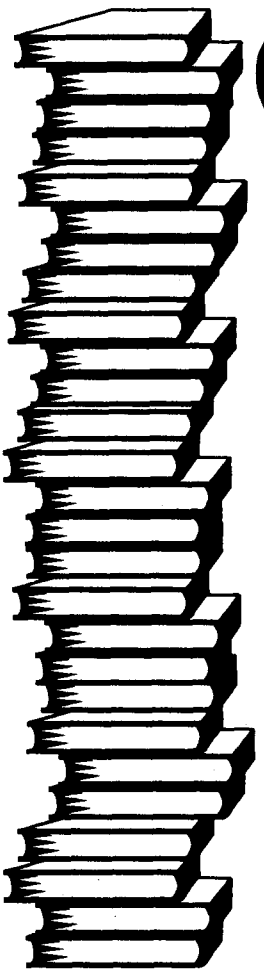

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flimsies. He drew breath, and looked Miles straight in the eyes. "So, Lord Vorkosigan—the funeral rotunda was *not* the first time you saw the Ba Lura, was it?" Benin was trying for the rattling unexpected straight shot, to unnerve his quarry. "Correct," Miles answered, with a smile.

Expecting denial, Benin already had his mouth open for the second strike, probably the presentation of some telling piece of evidence that would give the Barrayaran the lie. He had to close it again, and start over. "If . . . if you wished to keep it a secret, why did you as much as flat out tell me to look where I would be sure to find you? And," his tone sharpened with baffled annoyance, "if you didn't want to keep it a secret, why didn't you tell me about it in the first place?"

"It provided an interesting test of your competence. I wanted to know if it would be worth my while to persuade you to share your results. Believe me, my first encounter with the Ba Lura is as much a mystery to me as I'm sure it is to you."

Even from beneath the gaudy face paint, the look Benin gave Miles reminded him forcibly of the look he got all too often from superiors. He even capitalized it in his mind, The Look. In a weird back-handed way, it made him feel quite comfortable with Benin. His smile became slightly cheerier.

"And . . . how *did* you encounter the Ba?" said Benin.

"What do you know so far?" Miles countered. Benin would, of course, keep something back, to cross-check Miles's story. That was quite all right, as Miles proposed to tell almost the whole truth, next.

"Ba Lura was at the transfer station the day you arrived. He left the station at least twice. Once, apparently, from a pod docking bay in which the security monitors were deactivated and unchecked for a period of forty minutes. The same bay and the same period in which you arrived, Lord Vorkosigan."

"Our first arrival, you mean."

". . . Yes."

Vorreedi's eyes were widening and his lips were thinning. Miles ignored him, for now, though Ivan's gaze cautiously shifted to check him out.

"Deactivated? Torn out of the wall, I'd call it. Very well, ghem-Colonel. But tell me—was our encounter in the pod dock the first or second time the Ba appeared to leave the station?"

"Second," Benin said, watching him closely.

"Can you prove that?"

"Yes."

"Good. It may be *very important* later that you can prove that." Ha, Benin wasn't the only one who could cross-check the truth of this conversation. Benin, for whatever reason, was being straight with him so far. Turn and turnabout. "Well, this is what happened from our point of view—"

In a flat voice, and with plenty of corroborative physical details, Miles described their confusing clash with the Ba. The only item he changed was to report the Ba reaching for its trouser pocket before he'd yelled his warning. He brought the tale up to the moment of Ivan's heroic struggle and his own retrieval of the loose nerve disruptor, and bounced it over to Ivan to finish.

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Ivan gave him a dirty look, but, taking his tone from Miles, offered a brief factual description of the Ba's subsequent escape.

Since it lacked face paint, Miles could watch Vorreedi's face darken, out of the corner of his eye. The man was too cool and controlled to actually turn purple or anything, but Miles bet a blood pressure monitor would be beeping in plaintive alarm right now.

"And why did you not report this at our first meeting, Lord Vorkosigan?" Benin asked again, after a long, digestive pause.

"I might," said Vorreedi in a slightly suffused voice, "ask you the same question, Lieutenant." Benin shot Vorreedi a raised-brow look, almost putting his face-paint in danger of smudging.

Lieutenant, not *my lord;* Miles took the point. "The pod pilot reported to his captain, who will have reported to his commander." To wit, Illyan; in fact, the report, slogging through normal channels, should be reaching Illyan's desk right about now. Three days more for an emergency query to arrive on Vorreedi's desk from home, six more days for a reply and return-reply. It would all be over before Illyan could do a damned thing, now. "However, on my authority as senior envoy, I suppressed the incident for diplomatic reasons. We were sent with specific instructions to maintain a low profile and behave with maximum courtesy. My government considered this solemn occasion an important opportunity to send a message that we would be glad to see more normal trade and other relations, and an easing of tensions along our mutual borders. I did not judge that it would do anything helpful for our mutual tensions to open our visit with charges of an unmotivated armed attack by an Imperial slave upon the Barrayaran special representatives."

The implied threat was obvious enough; despite Benin's face paint, Miles could tell that one had hit home. Even Vorreedi looked like he might be giving the pitch serious consideration.

"Can you . . . prove your assertions, Lord Vorkosigan?" asked Benin cautiously.

"We still have the captured nerve disruptor. Ivan?" Miles nodded to his cousin.

Gently, using only his fingertips, Ivan drew the weapon from his pocket and laid it gingerly on the table, and returned his hands demurely to his lap. He avoided Vorreedi's outraged eye. Vorreedi and Benin reached simultaneously for the nerve disruptor, and simultaneously stopped, frowning at each other.

"Excuse me," said Vorreedi. "I had not seen this before."

"Really?" said Benin. *How extraordinary,* his tone implied. "Go ahead." His hand dropped politely.

Vorreedi picked up the weapon and examined it closely, among other things checking to see that the safety lock was indeed engaged, before handing it equally politely to Benin.

"I'd be glad to return the weapon to you, ghem-Colonel," Miles went on, "in exchange for whatever information you are able to deduce from it. If it can be traced back to the Celestial Garden, that's not much help, but if it was something the Ba acquired en route, well . . . it might be revealing. This is a

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check that you can make more easily than I can." Miles paused, then added, "Who did the Ba visit from the station the first time?"

Benin glanced up from his close contemplation of the nerve disruptor. "A ship moored off-station."

"Can you be more specific?"

"No."

"Excuse me, let me rephrase that. Could you be more specific if you chose to?"

Benin set the disruptor down, and leaned back, his expression of attention to Miles, if possible, intensifying. He was silent for a long thoughtful moment before finally replying, "No, unfortunately. I could not."

Rats. The three haut governors' ships moored off that transfer station were Ilsum Kety's, Slyke Giaja's and Este Rond's. This could have been the final line of his triangulation, but Benin didn't have it. Yet. "I'd be particularly interested in how traffic control, or what certainly passed for traffic control, came to direct us to the wrong, or at any rate the first, pod dock."

"Why do *you* think the Ba entered your pod?" Benin asked in turn.

"Given the intense confusion of the encounter, I certainly would consider the possibility of it having been an accident. If it *was* arranged, I think something must have gone very wrong."

No shit, said Ivan's silent morose look. Miles ignored him.

"Anyway, ghem-Colonel, I hope this helps to anchor your timetable," Miles continued in a tone of finality. Surely Benin would be itching to run and check out his new clue, the nerve disruptor.

Benin didn't budge. "So what did you and the haut Rian *really* discuss, Lord Vorkosigan?"

"For that, I'm afraid you will have to apply to the haut Rian. She is Cetagandan to the bone, and so all your department." *Alas.* "But I think her distress at the death of the Ba Lura was quite genuine."

Benin's eyes flicked up. "When did *you* see enough of her to gauge the depth of her distress?"

"Or so I deduced." And if he didn't end this *now* he was going to put his foot in it so deep they'd need a hand-tractor to pull it out again. He had to play Vorreedi with the utmost delicacy; this was not quite the case with Benin. "This is fascinating, ghem-Colonel, but I'm afraid I'm out of time for this morning. But if you ever find out where that nerve disruptor came from, and where the Ba went to, I would be more than glad to continue the conversation." He sat back, and folded his arms, and smiled cordially.

What Vorreedi *should* have done was announce loudly that they had all the time in the world, and let Benin continue to be his stalking-horse—Miles would have, in his place—but Vorreedi himself was clearly itching to get Miles alone. Instead, the protocol officer rose, signaling the official end to the interview. Benin, on embassy grounds as a guest, on sufferance—not his normal mode, Miles was sure—acceded without comment, rising to take his farewells.

"I *will* be speaking with you again, Lord Vorkosigan," Benin promised darkly.

"I certainly hope so, sir. Ah—did you

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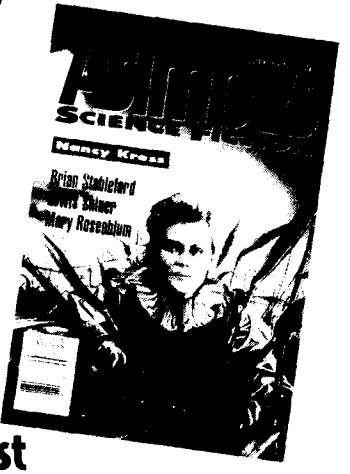

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take my other piece of advice, too? About blocking interference?"

Benin paused, looking suddenly a little abstracted. "Yes, in fact."

"How did it go?"

"Better than I would have expected."

"Good."

Benin's parting semi-salute was ironic, but not, Miles felt, altogether hostile.

Vorreedi escorted his guest to the door, but turned him over to the hall guard and was back in the little room before Miles and Ivan could make good their escape.

Vorreedi pinned Miles by eye. Miles felt a momentary regret that his diplomatic immunity did not extend to the protocol officer as well. Would it occur to Vorreedi to separate the pair of them, and break Ivan? Ivan was practicing looking invisible, something he did very well.

Vorreedi stated dangerously, "I am not a mushroom, Lieutenant Vorkosigan."

To be kept in the dark and fed on horseshit, right. Miles sighed inwardly. "Sir, apply to my commander," meaning Illyan—Vorreedi's commander too, in point of fact—"be cleared, and I'm yours. Until then, my best judgment is to continue exactly as I have been."

"Trusting your instincts?" said Vorreedi, dryly.

"It's not as if I had any clear conclusions to share yet."

"So . . . do your instincts suggest some connection between the late Ba Lura, and Lord Yenaro?"

Vorreedi had instincts too, oh, yes. Or he wouldn't be in *this* post. "Besides the fact that both have interacted with me? Nothing that I . . . trust. I'm after proof. Then I will . . . be somewhere."

"Where?"

Head down in the biggest privy you ever imagined, at the current rate. "I guess I'll know when I get there, sir."

"We, too, will speak again, Lord Vorkosigan. You can count on it." Vorreedi gave him a very abbreviated nod, and departed abruptly—probably to apprise Ambassador Vorob'yev of the new complications in his life.

Into the ensuing silence, Miles said faintly, "That went well, all things considered."

Ivan's lip curled in scorn.

They kept silence on the trudge back to Ivan's room, where Ivan found a new stack of colored papers waiting on his desk. He sorted through them, pointedly ignoring Miles.

"I have to reach Rian somehow," Miles said at last. "I can't afford to wait. Things are getting too damned tight."

"I don't want anything more to do with any of this," said Ivan distantly.

"It's too late."

"Yes. I know." His hand paused. "Huh. Here's a new wrinkle. This one has both our names on it."

"Not from Lady Benello, is it? I'm afraid Vorreedi will count her off-limits now."

"No. It's not a name I recognize."

Miles pounced on the paper, and tore it open. "Lady D'Har. A garden party. What does she grow in *her* garden, I wonder? Could it be a double meaning—referencing the Celestial Garden? Hm. Awfully short notice. It could be my next contact. God, I hate

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being at haut Rian's mercy for every set-up. Well, accept it anyway, just in case."

"It's not my first choice of how to spend the evening," said Ivan.

"Did I say anything about a choice? It's a chance, we've got to take it." He went on nastily, "Besides, if you keep leaving your genetic samples all over town, your progeny could end up being featured in next year's art show. As bushes."

Ivan shuddered. "You don't think they would—that's not why—uh, could they?"

"Sure. Why, when you're gone, they could recreate the operative body parts that interest them, to perform on command, to any scale—quite the souvenir. And you thought that *kitten* tree was obscene."

"There's more to it than *that,* coz," Ivan stated with injured dignity. His voice faded in doubt, ". . . you don't think they'd really do something like that, do you?"

"There's no more ruthless passion than that of a Cetagandan artist in search of new media." He added firmly, "We're going to a garden party. I'm sure it's my contact with Rian."

"Garden party," conceded Ivan with a sigh. He stared off blankly into space. After a minute he commented offhandedly, "Y'know, it's too bad she can't just get the gene bank back from his ship. Then he'd have the key but no lock. *That'd* fox him up but good, I bet."

Miles sat down in Ivan's desk chair, slowly. When he'd got his breath back, he whispered, "Ivan—that's *brilliant.* Why didn't I think of that before?"

Ivan considered this. " 'Cause it's not a scenario that lets you play the lone hero in front of the haut Rian?"

They exchanged saturnine looks. For once, Miles's gaze shifted first. "I meant that as a rhetorical question," he said tightly. But he didn't say it very loudly.

CHAPTER TWELVE

Garden party was a misnomer, Miles decided. He stared past Ambassador Vorob'yev and Ivan as the three of them exited from an ear-popping ride up the lift tube and into the apparently open air of the rooftop. A faint golden sparkle in the air above marked the presence of a lightweight force screen, blocking unwanted wind, rain, or dust. Dusk here, in the center of the capital, was a silver sheen in the atmosphere, for the half-kilometer high building overlooked the green rings of parkway surrounding the Celestial Garden itself.

Curving banks of flowers and dwarf trees, fountains, rivulets, walkways, and arched jade bridges turned the roof into a descending labyrinth in the finest Cetagandan style. Every turn of the walkways revealed and framed a different view of the city stretching to the horizon, though the best views were the ones that looked to the Emperor's shimmering great phoenix egg in the city's heart. The lift-tube foyer, opening onto it all, was roofed with arching vines and paved in an elaborate inlay of colored stones: lapis lazuli, malachite, green and white jade, rose quartz, and other minerals Miles couldn't even name.

Looking around, it gradually dawned

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on Miles why the protocol officer had them all wearing their House blacks, when Miles would have guessed dress greens to be adequate. It was not possible to be overdressed, here. Ambassador Vorob'yev was admitted on sufferance as their escort, but even Vorreedi had to wait in the garage below, tonight. Ivan, looking around too, clutched their invitation a little tighter.

Their putative hostess, Lady d'Har, stood on the edge of the foyer. Apparently being inside her home counted the same as being inside a bubble, for she was welcoming her guests. Even at her advanced age, her haut beauty stunned the eye. She wore robes in a dozen fine layers of blinding white, sweeping down and swirling around her feet. Thick silver hair flowed to the floor. Her husband, ghem-Admiral Har, whose bulky presence would normally have dominated any room, seemed to fade into the background beside her.

Ghem-Admiral Har commanded half the Cetagandan fleet, and his duty-delayed arrival for the final ceremonies of the Empress's funeral was the reason for tonight's welcome-home party. He wore his Imperial blood-red dress uniform, which he could have hung with enough medals to sink him should he chance to fall in a river. He'd chosen instead to one-up the competition with the neck-ribbon and medallion of the deceptively simple-sounding Order of Merit. Clearing away the other clutter made this honor impossible for the viewer to miss. Or match. It was given, rarely, at the sole discretion of the Emperor himself. There were few higher awards to be had in the Cetagandan Empire. The haut-lady by his side was one of them, though. Lord Har would have pinned her to his tunic too, if he could, Miles felt, for all he had won her some forty years past. The Har ghem-clan's face paint featured mainly orange and green; the patterns lacked definition, crossing with the man's deeply age-lined features, and clashing horribly with the red of the uniform.

Even Ambassador Vorob'yev was awed by ghem-Admiral Har, Miles judged by the extreme formality of his greetings. Har was polite but clearly puzzled; *Why are these outlanders in my garden?* But he deferred to Lady d'Har, who relieved Ivan of his nervously proffered invitation with a small, cool nod, and directed them, in a voice age-softened to a honeyed alto, to where the food and drinks were displayed.

They strolled on. After he recovered from the shock of Lady d'Har, Ivan's head swiveled, looking for the young ghem-women he knew, without success. "This place is wall-to-wall old crusts," he whispered to Miles in dismay. "When we walked in, the average age here dropped from ninety to eighty-nine."

"Eighty-nine and a half, I'd say," Miles whispered back.

Ambassador Vorob'yev put a finger to his lips, suppressing the commentary, but his eyes glinted in amused agreement.

Quite. This was the real thing; Yenaro and his crowd were shabby little outsiders indeed, by comparison, excluded by age, by rank, by wealth, by . . . everything. Scattered through the garden were half-a-dozen haut-lady bubbles, glowing like pale lanterns,

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something Miles had not yet seen outside the Celestial Garden itself. Lady d'Har kept social contact with her haut-relatives, or former relatives, it appeared. *Rian, here?* Miles prayed so.

"I wish I could have got Maz in," Vorob'yev sighed with regret. "How *did* you do this, Lord Ivan?"

"Not me," denied Ivan. He flipped a thumb at Miles. Vorob'yev's brows rose inquiringly.

Miles shrugged. "They told me to study the power-hierarchy. This is it, isn't it?" Actually, he was not so sure any more.

Where did power lie, in this convoluted society? With the ghem-lords, he would have said once without hesitation, who controlled the weapons, the ultimate threat of violence. Or with the haut-lords, who controlled the ghem, through whatever oblique means. Certainly not with the secluded haut-women. Was their knowledge a kind of power, then? A very fragile sort of power. Wasn't *fragile power* an oxymoron? The Star Crèche existed because the Emperor protected it; the Emperor existed because the ghem-lords served him. Yet the haut-women had created the Emperor . . . created the haut itself . . . created the ghem, for that matter. Power to create . . . power to destroy . . . he blinked, dizzy, and munched a canapé in the shape of a tiny swan, biting off its head first. The feathers were made with rice flour, judging from the taste, the center a spicy protein paste. Vat-grown swan meat?

The Barrayaran party collected drinks, and began a slow circuit of the rooftop garden's walks, comparing views. They also collected stares, from the elderly ghem and haut scattered about; but none came up to introduce themselves, or ask questions, or attempt to start a conversation. Vorob'yev himself was only scouting, so far, Miles thought, but the man would surely pursue the evening's opportunities for contact-making soon. How Miles was to divest himself of the ambassador when his own contact turned up, he was not sure. Assuming this was where his contact was to meet him, and it wasn't all just his hyperactive imagination, or—

Or the next assassination attempt. They'd rounded some greenery to see a woman in haut-white, but with no haut-bubble, standing alone and staring out over the city. Miles recognized her from the heavy chocolate-dark braid falling down her back to her ankles, even at this three-quarters-turned view. The haut Vio d'Chilian. Was ghem-General Chilian here? Was Kety himself?

Ivan's breath drew in. Right. Except for their elderly hostess, this was the first time Ivan had seen a haut-woman outside her bubble, and Ivan lacked the . . . inoculation of the haut Rian. Miles found he could view the haut Vio this time with scarcely a tremor. Were the haut-women a disease that you could only catch once, like the legendary smallpox, and if you survived it you were immune thereafter, however scarred?

"Who *is* she?" whispered Ivan, enchanted.

"Ghem-General Chilian's haut-wife," Vorob'yev murmured into his ear. "The ghem-general could order your liver fried for breakfast. *I* would send it to

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him. The free ghem-ladies can entertain themselves as they please with you, but the married haut are strictly off-limits. Understood?"

"Yes, sir," said Ivan faintly.

The haut Vio was staring as if hypnotized at the great glowing dome of the Celestial Garden. Longing for her lost life, Miles wondered? She'd spent years exiled in the hinterlands at Sigma Ceta with her ghem husband. What was she feeling, now? Happy? Homesick?

Some movement or sound from the Barrayarans must have broken her reverie, for her head turned toward them. For a second, just a second, her astonishing cinnamon eyes seemed copper-metallic with a rage so boundless, Miles's stomach lurched. Then her expression snapped into a smooth hauteur, as blank as the bubble she lacked, and as armored; the open emotion was gone so fast Miles was not sure the other two men had even seen it. But the look was not for them; it had been on her face even as she'd turned, before she could have identified the Barrayarans, blackly dressed in the shadows.

Ivan opened his mouth; *Please, no,* Miles thought, but Ivan had to try. "Good evening, milady. Wonderful view, eh?"

She hesitated a long moment—Miles pictured her fleeing—but then answered, in a low-pitched, perfectly modulated voice, "There is nothing like it in the Universe."

Ivan, encouraged, brightened and moved forward. "Let me introduce myself. I'm Lord Ivan Vorpatril, of Barrayar. And, uh, this is Ambassador Vorob'yev, and this is my cousin, Lord Miles Vorkosigan. Son of you-know-who, eh?"

Miles winced. Watching Ivan babble in sexual panic would normally be entertaining, it if wasn't so excruciatingly embarrassing. It reminded Miles painfully of—himself. *Did I look like that much of a fool, the first time I saw Rian?* He feared the answer was *yes.*

"Yes," said the haut Vio. "I know." Miles had seen people talk to their potted plants with more warmth and expression than the haut Vio turned on Ivan.

Give it up, Ivan, Miles urged silently. *This woman is married to the first officer of a guy who maybe tried to kill us yesterday, remember?* Unless Lord X *was* Prince Slyke after all—or the haut Rond, or . . . Miles ground his teeth.

But before Ivan could dig himself any deeper, a man in Cetagandan military uniform rounded the corner, his face paint crinkling with his frown. Ghem-General Chilian. Miles froze, his hand wrapping Ivan's forearm and biting deep in warning.

Chilian's gaze swept the Barrayarans, his nostrils flaring in suspicion. "Haut Vio," he addressed his wife. "Come with me, please."

"Yes, my lord," she said, her lashes sweeping down demurely, and she escaped around Ivan with a bare nod of farewell. Chilian brought himself to nod also, acknowledging the outlanders' existence; with an effort, Miles felt. The general glanced once back over his shoulder as he whisked his wife away. So what sin had ghem-General Chilian committed to win *her?*

"*Lucky* guy," sighed Ivan in envy.

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"I'm not so sure," said Miles. Ambassador Vorob'yev just smiled grimly.

They walked on, Miles's brain whirling around this new encounter. Was it accidental? Was it the start of a new setup? Lord X used his human tools like long-handled forks, to keep the heat at a distance. Surely the ghem-general and his wife were too close to him, too obviously connected. Unless, of course, Lord X wasn't Kety after all. . . .

A glow ahead brought Miles's gaze front and center. A haut-bubble was approaching them along the evergreen-bounded walk. Vorob'yev and Ivan stood aside to let it pass. Instead it stopped in front of Miles.

"Lord Vorkosigan." The woman's voice was melodious even through the filter, but it was not Rian's. "May I speak privately with you?"

"Of course," said Miles, before Vorob'yev could put in an objection. "Where?" Tension shot through him. Was tonight to be his final assault already, upon the new target of Governor Ilsum Kety's ship? Too premature, still too uncertain. . . . "And for how long?"

"Not far. We will be about an hour."

Not nearly long enough for a trip to orbit; this was something else, then. "Very well. Gentlemen, will you excuse me?"

Vorob'yev looked about as unhappy as his habitual control would allow. "Lord Vorkosigan. . . ." His hesitation was actually a good sign; Vorreedi and he must have had a long and extraordinary talk. "Do you wish a guard?"

"No."

"A comm link?"

"No."

"You *will* be careful?" Which was diplomatic for *Are you sure you know what the hell you're doing, boy?*

"Oh, yes, sir."

"What do we do if you're *not* back in an hour?" said Ivan.

"Wait." He nodded cordially, and followed the bubble down the garden path.

When they turned into a private nook, lit by low colored lanterns and screened by flowering bushes, the bubble rotated, and abruptly blinked out. Miles found himself facing another haut beauty in white, riding in her float chair like a throne. This woman's hair was honey-blonde, intricately woven and tucked up around her shoulders, vaguely reminiscent of a gilt chain-mail neck guard. He would have guessed her age as forty-standard, which meant she was probably twice that.

"The haut Rian Degtiar instructs me to bring you," she stated. She moved her robes from the left side of the chair, uncovering a thickly padded armrest. "We have not much time." Her gaze seemed to measure his height, or shortness. "You can, um . . . *perch* here, and ride."

"How . . . fascinating." If only she *were* Rian. . . . But this would test certain theories he had about the mechanical capacities of haut-bubbles, oh yes. "Uh . . . identification, milady?" he added almost apologetically. The last person he suspected of experiencing such a ride had ended up with its throat cut, after all.

She nodded, as if expecting this, and turned her hand outward, displaying the ring of the Star Crèche.

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That was probably about as good as they could do, under the circumstances. Cautiously, he approached, and eased himself aboard, grasping the back of the chair above her head for balance. Each was careful not to actually touch the other. Her long-fingered hand moved over the control panel embedded in the right armrest, and the force field snapped on again. The pale white light reflected off the flowered bushes, bringing out their color, and cast a glow before them as they began to move down the path.

Their view was quite clear, scarcely impeded by an eggshell-thin, ghostly sphere of mist that marked the boundary of the force-field as seen from this side. Sound, too, was transmitted with high clarity, much better than the deliberately-muffled reverse effect. He could hear voices, and the clink of glassware, from a balcony above. They passed Ambassador Vorob'yev and Ivan again, who stared curiously, uncertain, of course, if this was the same bubble they'd seen before. Miles squelched an absurd impulse to wave at them, going by.

They came not to the lift-tube foyer, as Miles had expected, but to the edge of the rooftop garden. Their silver-haired hostess was standing waiting. She nodded at the bubble, and coded open the force screen, letting the bubble pass through onto a small private landing pad. The reflected glow off the pavement darkened, as the haut woman blacked out her bubble. Miles stared upward at the shimmering night sky, looking for the lightflyer or aircar.

Instead, the bubble moved smoothly to the edge of the building and dropped straight over the side.

Miles clutched the seat-back convulsively, trying not to scream, fling his arms around his hostess-pilot's neck, or throw up all over her white dress. They were *free-falling*, and he *hated* heights. Was this his intended death, his assassin sacrificing herself along with him? *Oh, God—!*

"I thought these things only went a meter in the air," he choked out, his voice, despite his best efforts, going high and squeaky.

"If you have enough initial altitude, you can maintain a controlled glide," she said calmly. Despite Miles's horrified first impression, they were not actually dropping like a rock. They were arcing outward, across the boulevards far below, and the light-sparked green rings of parks, toward the dome of the Celestial Garden.

Miles thought wildly of the witch Baba Yaga, from the Barrayaran folk tales, who flew in a magic mortar. This witch didn't qualify as old and ugly. But he was not, at this moment, totally convinced she didn't eat bad children.

In a few minutes, the bubble decelerated again to a smooth walking pace a few centimeters above the pavement outside one of the Celestial Garden's minor entrances. A movement of her finger brought back the white glow.

"Ah," she said, in a refreshed tone. "I haven't done that in *years*." She almost cracked a smile, for a moment nearly . . . human.

Miles was shocked when they passed through the Celestial dome's security procedures almost as if they weren't there, except for a swift exchange of electronic codes. No one

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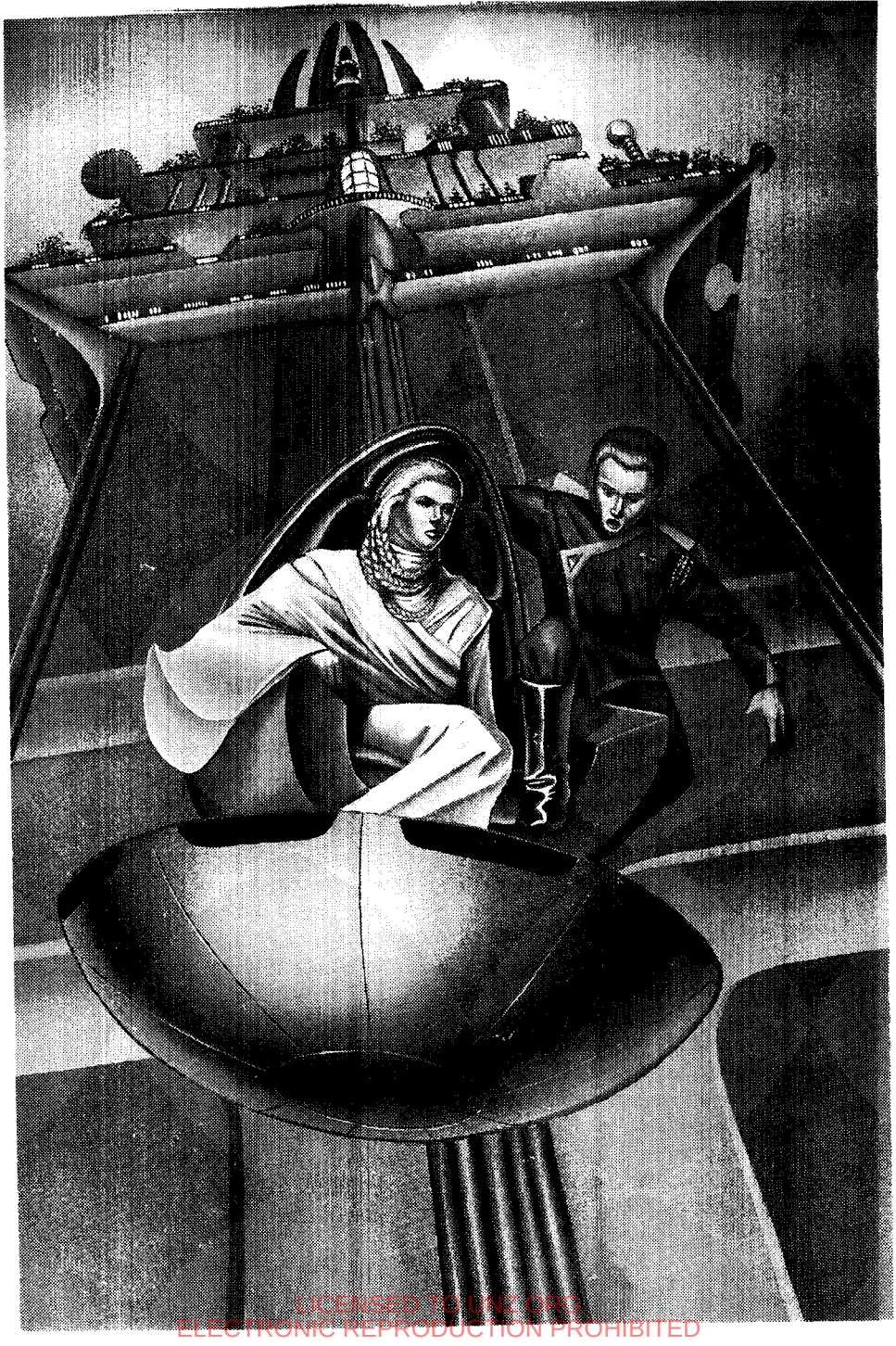

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stopped or searched the bubble. The sort of uniformed men who'd shaken down the galactic envoys with beady-eyed thoroughness stood back respectfully, with downcast gaze.

"Why don't they stop us?" Miles whispered, unable to overcome the psychological conviction that if he could see and hear them, they could see and hear him.

"Stop me?" repeated the haut woman in puzzlement. "I am the haut Pel Navarr, Consort of Eta Ceta. I *live* here."

Their further progress was happily ground-hugging, if faster than the usual walking-pace, through the increasingly familiar precincts of the Celestial Garden to the low white building with the bio-filters on every window. The haut Pel's passage through its automated security procedures was almost as swift and perfunctory as through the dome entrance itself. They passed silently down a set of corridors, but turned in a different direction from the labs and offices at the building's heart, and went up one level.

Double doors parted to admit them to a large circular room done in subdued and subduing tones of silvery gray. Unlike any other place he'd seen in the Celestial Garden, it was devoid of living decorations, neither plant nor animal nor any of those disturbing creations in-between. Hushed, concentrated, undistracting . . . it was a chamber in the Star Crèche; he supposed he could dub it the Star Chamber. Eight women in white awaited them, sitting silently in a circle. His stomach should not still be turning over, dammit, the free fall was done.

The haut Pel brought her float-chair to a halt in a waiting empty gap in the circle, grounded it, and switched off the force bubble. Eight extraordinary pairs of eyes focused on Miles.

No one, he thought, *should be exposed to this many haut women at once.* It was some kind of dangerous overdose. Their beauty was varied; three were as silver-haired as the ghem-admiral's wife, one was copper-tressed, one was dark-skinned and hawk-nosed, with masses of blue-black ringlets tumbling down around her like a cloak. Two were blonde, his guide with her golden weave and another with hair as pale as oat straw in the sun, and as straight to the floor. One dark-eyed woman had chocolate-brown hair like the haut Vio, but in soft curling clouds instead of bound. And then there was Rian. Their massed effect went beyond beauty; where to, he was not sure, but *terror* came close. He slipped off the arm of the float chair, and stood away from it, grateful for the propping effect of his stiff high boots.

"Here is the Barrayaran to testify," said the haut Rian.

Testify. He was here as a witness, then, not as the accused. A Key witness, so to speak. He stifled a slightly manic giggle. Somehow he did not think Rian would appreciate the pun.

He swallowed, and got his voice unlocked. "You have the advantage of me, ladies." Though he could make a good guess who they all were, at this point. His gaze swept the circle, and he blinked hard against the vertigo. "I have only met your Handmaiden." He nodded toward Rian. On a low table before her the Empress's entire formal

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regalia was laid out, including the Seal and the false Great Key.

Rian tilted her head in acknowledgment of the reasonableness of his request, and proceeded to go around the circle with a bewildering slug of haut names and titles—yes, here indeed sat the consorts of the eight satrap planets. With Rian the ninth, sitting in for the late empress. The creative controllers of the haut genome, of the would-be master race, were all met here in some extraordinary council.

The chamber was clearly set up for just this purpose; such meetings must also occur when the consorts journeyed home to escort the child-ships. Miles particularly focused on the consorts of Prince Slyke, Ilsum Kety, and the Rond. Kety's woman, the Consort of Sigma Ceta, was one of the silver-haired ones, closer to being contemporary with the late Empress than anyone else in the room. Rian introduced her as the haut Nadina. The oat-straw blonde served Prince Slyke of Xi Ceta, and the brown-curled woman was the Consort of Rho Ceta. Miles wondered anew at the significance of their titles, which named them all consorts of their planets, not of the men.

"Lord Vorkosigan," said the haut Rian. "I would like you to repeat for the consorts how you say you came into possession of the false Great Key, and all the subsequent events."

All? Miles did not blame her in the least for switching strategies from playing all cards close to her chest to calling in reinforcements. It was not before time, in his opinion. But he disliked being taken by surprise. It would have been nice if she'd at least *consulted* him, first. *Yeah? How?*

"I take it you understood my message to abort the infiltration of Prince Slyke's ship," he countered.

"Yes. I expect you will explain why, in due order."

"Excuse me, milady. I do not mean to insult . . . anyone here. But if one of the consorts is a traitoress, in collusion with her satrap governor, this will pipeline everything we know straight to him. How do you *know* you are entirely among friends?"

There was enough tension in the room to go with any number of treasons, certainly. Rian raised a hand, as if to stem it. "He is an outlander. He cannot understand." She gave him a slow nod. "There is treason, we believe, yes, but not on *this* level. Further down."

"Oh. . . ?"

"We have concluded that even with the bank and Key in his hands, the satrap governor could not run the haut genome by himself. The haut of his satrap would not cooperate with such a sudden usurpation, the over-turning of all custom. He must plan to appoint a new consort, one under his own control. We think she has already been selected."

"Ah . . . do you know who?"

"Not yet," Rian sighed. "Not yet. She is someone, I fear, who does not wholly understand the goal of haut. It is all of a piece. If we knew which governor, we could guess which haut-woman he has suborned; if we knew which woman . . . well."

Dammit, this triangulation *had* to break soon. Miles chewed on his lower lip, then said slowly, "Milady. Tell me—if you can—something about how

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your force-bubbles are keyed to their individual operators, and why everyone is so damned convinced they're dead-secure. The keypad on those control panels looks like a palm-lock, but it can't just be a palm-lock; you can get around palm-locks."

"I cannot give *you* the technical details, Lord Vorkosigan," said Rian.

"I don't expect you to. Just the general logic of it."

"Well . . . they are keyed genetically, of course. One brushes one's hand across the pad, leaving a few skin cells. These are sucked in and scanned."

"Does it scan your entire genome? Surely that would take a lot of time."

"No, of course not. It runs through a tree of a dozen or so critical markers that individually identify a haut-woman. Starting with the presence of an X chromosome pair, and going down a branching list until confirmation is achieved."

"How much chance is there of duplicating the markers in two or more individuals?"

"We do not clone ourselves, Lord Vorkosigan."

"I mean, just of the dozen factors, just enough to fool the machine."

"Vanishingly small."

"Even among closely-related members of one's own constellation?"

She hesitated, exchanging a glance with Lady Pel, who raised her brows thoughtfully.

"There's a reason I ask," Miles went on. "When ghem-Colonel Benin interviewed me, he let slip that six haut-bubbles had entered the funeral rotunda during the time period the Ba Lura's body must have been placed at the foot of the bier, and that it presented him with a major puzzle. He didn't tell me which six, but I bet you could get him to disgorge the list. It's a brute-force triage of a major data dump, but—suppose you ran the markers of those six through your records, and checked for accidental duplicates among living haut-women. If the woman is serving the satrap governor, she might have served him in that murder, too. You might finger your traitoress without ever having to leave the Star Crèche."

Rian, momentarily alert, sat back with a weary sigh. "Your reasoning is correct, Lord Vorkosigan. We could do that—if we had the Great Key."

"Oh," said Miles. "Yeah. That." He reverted from an eager parade-rest to a deflated at-ease. "For what it's worth, my strategic analysis, and what little physical evidence I've wrung from ghem-Colonel Benin, so far suggests either Prince Slyke or the haut Ilsum Kety. With the haut Rond a distant third. But as Rho Ceta and Mu Ceta would bear the brunt of it if open conflict with Barrayar was actually engineered, my own choice has settled pretty firmly between Slyke and Kety. Recent . . . events point to Kety." He glanced again around the circle. "Is there anything any of the consorts have seen or heard, or overheard, that would help pin him more certainly?"

A murmur of negatives. "Unfortunately, no," said Rian. "We have discussed that problem already this evening. Please begin."

On your head be it, milady. Miles took a deep breath, and launched into the full true account, minus most of his

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opinions, of his experiences on Eta Ceta from the moment the Ba Lura lurched into their personnel pod. He paused occasionally, to give Rian a chance to hint him away from anything she wanted to conceal. She appeared to want to conceal nothing, instead drawing him on with skillful questions and prompts to disgorge every detail.

Rian had seen, he slowly realized, that the secrecy problem cut two ways. Lord X could assassinate Miles, maybe Rian as well. But even the most megalomanic Cetagandan politician must find it excessively challenging to try to get away with disposing of all eight satrap consorts. His voice strengthened.

He felt his underlying assumptions slowly wringing inside-out. Rian seemed less and less like a damsel in distress all the time. In fact, he was beginning to wonder if he was trying to rescue the dragon. *Well, dragons need rescuing too, sometimes.* . . . Nobody even blinked at his description of his near-assassination the day before. If anything, there was a subliminal murmur of appreciation for its elegance of form and style, and of faintly sympathetic disappointment at its foiling. The judges had no appreciation for the governor's originality in attempting to muscle in on their own territory, though. The Sigma and Xi Cetan consorts looked increasingly stony, exchanging a raised-brow glance or a nod of understanding now and then.

There was a long silence when he'd finished. Time to present Plan B? "I have a suggestion," Miles said boldly. "Recall all the duplicate gene banks from the satrap governors' ships. If they are all returned, you will have stripped him of his ability to carry out his larger plans. If he resists releasing it, you will have smoked him out."

"Bring them *back,*" said the haut Pel in dismay. "Do you have any idea how much trouble we had getting them *up* there?"

"But he might take both bank and Key, and flee," objected the brown-curled Consort of Rho Ceta.

"No," said Miles. "That's the one thing he *can't* do. There are too many Imperially-guarded wormhole jumps between him and home. Speaking militarily, open flight is impossible. He'd never make it. He cannot reveal a thing about any of this till he's safely in orbit around . . . Something Ceta. In a weird way, we have him cornered till the funeral is over." *Which will be all too soon, now.*

"That still leaves the problem of retrieving the real Key," said Rian.

"Once you have the bank back, you may be able to negotiate the Key's return, in exchange for, say, amnesty. Or you can claim he stole it—perfectly true—and set your own security to get it back for you. Once the other governors are freed of the incriminating evidence they're holding, you may be able to cut him out of the herd, so to speak, with their good will. In any case, it will open up a lot of tactical options."

"He may threaten to destroy it," worried the Consort of Sigma Ceta.

"You must know Ilsum Kety better than anyone else here, haut Nadina," said Miles. "Would he?"

"He is . . . an erratic young man," she said reluctantly. "I am not yet convinced that he is guilty. But I know

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nothing about him that makes your accusations impossible."

"And your governor, ma'am?" Miles nodded to the Consort of Xi Ceta.

"Prince Slyke is . . . a determined and brilliant man. The plot you describe is not beyond his capacities. I'm . . . not sure."

"Well . . . you *can* recreate the Great Key, eventually, can't you?" Push or shove, the Empress's great plan would be canned for a generation. A very desirable outcome, from Barrayar's point of view. Miles smiled agreeably.

A faint groan went around the room. "Recovering the Great Key undamaged is the highest priority," Rian said firmly.

"He still wants to frame Barrayar," said Miles. "It may have started as cold-blooded astropolitical calculation, but I'm pretty sure it's a personal motivation by now."

"If I recall the banks," said Rian slowly, "we will entirely lose this opportunity to distribute them."

The Consort of Sigma Ceta, the silver-haired Nadina, sighed, "I had hoped to live to see the Celestial Lady's vision of new growth carried out. She was right, you know. I have seen the stagnation increasing in my lifetime."

"Other opportunities will come," said another silver-haired lady.

"It must be done more carefully next time," said the brown-curled Consort of Rho Ceta. "Our Lady trusted the governors too much."

"I'm not so sure she did," said Rian. "I was only attempting to go as far as distributing inactive copies for backup. The Ba Lura felt our Mistress's desires keenly, but did not understand her subtlety. It wasn't *my* idea to attempt to distribute the Key now, and I'm not convinced it was hers, either. I don't know if the Ba had a separate understanding with her, or just a separate misunderstanding. And now I never will." She bowed her head. "I apologize to the Council for my failure." Her tone of voice made Miles think of inward-turning knives.

"You did your best, dear," said the haut Nadina kindly. But she added more sternly, "However, you should not have attempted to handle it all alone."

"It was my charge."

"A little less emphasis on the *my,* and a little more emphasis on the *charge,* next time."

Miles tried not to squirm at the general applicability of this gentle correction.

A glum silence reigned, for a time.

"We may need to consider altering the genome to make the haut-lords more controllable," said the Rho Cetan consort.

"For renewed expansion, we need the opposite," objected the dark consort. "More aggression."

"The ghem-experiment, filtering favorable genetic combinations upward from the general population, surely suffices for *that,*" said the haut Pel.

"Our Lady, in her wisdom, aimed at less uniformity, not more," conceded Rian.

"I believe we have long made a mistake in leaving the haut males so entirely to their own devices," said the Rho Cetan consort stubbornly.

Said the dark one, "But how else

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should we select among them, if there is no free competition to sort them out?"

Rian held up a restraining hand. "The time for this larger debate . . . must be soon. But not now. I myself have been convinced by these events that further refinement must come before further expansion. But that," she sighed, "is a new Empress's task. *Now* we must decide what state of affairs she will inherit. How many favor the recall of the gene banks?"

The ayes had it. Several were slow in coming, but in some occult way a unanimous vote was achieved through nothing more than an exchange of unreadable glances. Miles breathed relief.

Rian's shoulders slumped wearily. "Then I so order you all. Return them to the Star Crèche."

"As what?" asked the haut Pel in a practical tone.

Rian stared into the air a moment, and replied, "As collections of human genomic materials from your various satrapies, requested by the Lady before her death, and received by us in trust for the Star Crèche's experimental files."

"That will do nicely on this end," nodded the haut Pel. "And on the other end?"

"Tell your governors . . . we discovered a serious error in the copy, which must be corrected before the genome can be released to them."

"Very good."

The meeting broke up, the women activating their float chairs, though not yet their private bubbles, and leaving in twos and threes in a murmur of intense discussion. Rian and the haut Pel waited until the room emptied, and Miles perforce waited with them.

"Do you still want me to try and retrieve the Key for you?" Miles asked Rian. "Barrayar remains vulnerable until we nail the satrap governor with solid proof, data a clever man can't diddle. And I especially don't like the toehold he seems to have in your own security."

"I don't know," said Rian. "The return of the gene banks cannot take less than a day. I'll . . . send someone for you, as we did tonight."

"We'll be down to two days left, then. Not much margin. I'd rather go sooner than later."

"It cannot be helped." She touched her hair, a nervous gesture despite its grace.

Watching her, he searched his heart. The impact of his first mad crush was surely fading, in this drought of response, to be replaced by . . . what? If she had slaked his thirst with the least little drop of affection, he would be hers body and soul right now. In a way he was glad she wasn't faking anything, depressing as it was to be treated like a ba servitor, his loyalty and obedience assumed. Maybe his proposed disguise as a ba had been suggested by his subconscious for more than practical reasons. Was his backbrain trying to tell him something?

"The haut Pel will return you to your point of origin," Rian said.

He bowed. "In my experience, milady, we can never get back to exactly where we started, no matter how hard we try."

She returned nothing to this but an odd look, as he rode out again on the

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haut Pel's float chair.

Pel carried him through the Celestial Garden as before, in reverse. He wondered if she was as uncomfortable with their compressed proximity as he was. He made a stab at light conversation.

"Did the haut-ladies make all this plant and animal life in the garden? Competing, like the ghem bioestheties fair? I was particularly impressed by the singing frogs, I must say."

"Oh, no," said the haut Pel. "The lower life forms are all ghem work. That's their highest reward, to have their art incorporated into the Imperial garden. The haut only work in human material."

He didn't recall seeing any monsters around. "Where?"

"We mostly field-test ideas in the ba servitors. It prevents the accidental release of any genomic materials through sexual routes."

"Oh."

"*Our* highest honor is for a favorable gene complex we have developed to be taken up into the haut genome itself."

It was like some golden rule in reverse—never do unto yourself what you have not first tried on another. Miles smiled, rather nervously, and did not pursue the subject further. A ground-car driven by a ba servitor waited for the haut Pel's bubble at the side entrance to the Celestial Garden, and they were returned to Lady d'Har's penthouse by more normal routes.

Pel let him out of her bubble in another private nook, in an unobserved moment, and drifted away again. He pictured her reporting back to Rian—*Yes, milady, I released the Barrayaran back into the wild as you ordered. I hope he will be able to find food and a mate out there...* He sat on a bench overlooking the Celestial Garden, and meditated upon that view until Ivan and Ambassador Vorob'yev found him.

They looked, respectively, scared and angry. "You're late," said Ivan. "Where the hell did you go?"

"I almost called out Colonel Vorreedi and the guards," added Ambassador Vorob'yev sternly.

"That would have been . . . futile," sighed Miles. "We can go now."

"Thank God," muttered Ivan.

Vorob'yev said nothing. Miles rose, wondering how soon the ambassador and Vorreedi were going to stop taking *Not yet* for an answer.

Not yet. Please, not yet. ■

TO BE CONCLUDED IN THE NEXT ISSUE.

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Charles Sheffield

A HANDFUL OF HERESIES

1. INTRODUCTION.

A "scientific heresy" is a theory which runs contrary to the accepted scientific wisdom of a particular time. It may prove to be an improved description of Nature, so that it later (and often after much argument) itself becomes part of the standard world view; or it may prove to be misguided, and join the large group of discredited and crank theories.

We offer a brief miscellany of scientific heresies. They are intended only as capsule descriptions to whet the appetite. Whole books have been written about each idea, and a few of these are listed in Section 7, References.

2. GAIA: THE WHOLE EARTH MOTHER.

In the 1970s, James Lovelock published a controversial book, *Gaia*. In it he set forth his idea, long gestating, that the whole of Earth's biosphere should be thought of as a single, giant, self-regulating organism, which keeps the general global environment close to constant and in a state appropriate to sustain life. In Lovelock's own words, Gaia is "the model, in which

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the Earth's living matter, air, oceans and land surface form a complex system which can be seen as a single organism and which has the capacity to keep our planet a fit place for life."

Lovelock says that the notion is an old one, dating back at least to a lecture by James Hutton delivered in 1785. However, the modern incarnation of that idea is all Lovelock's, although the name *Gaia* as a descriptor for such an interdependent global entity was provided by William Golding, a Nobel laureate for literature and Lovelock's neighbor in England.

Something like Gaia seems to be needed from the following simple physical argument: Life has existed on Earth for about three and a half billion years. In that time, the Sun's energy output has increased by at least 30%. If Earth's temperature simply responded directly to the Sun's output, based on today's global situation we would expect that two billion years ago the whole Earth would have been frozen over. Conversely, if Earth was habitable then it should today be too hot to support life.

But in fact, the response of Earth's biosphere to temperature changes is complex, apparently adapting to minimize the effects of change. For example, as the amount of solar energy delivered to Earth increases, the rate of transpiration of plants increases, so the amount of atmospheric water vapor goes up. That means more clouds —and clouds reflect sunlight, and shield the surface, which tends to bring surface temperatures down. In addition, increased amounts of vegetation reduce the amount of carbon dioxide in the air, and that in turn reduces the greenhouse effect by which solar radiation is trapped within the atmosphere. Again, the surface temperature goes down. There are many other processes, involving other atmospheric gases, and the net effect is to hold the *status quo* for the benefit of living organisms. According to Lovelock, it is more than a matter of convenience. Only the presence of life has enabled Earth to remain habitable. If life had not appeared on this planet when it did, over three billion years ago, then by this time the surface of Earth would be beyond the range of temperatures at which life could exist.

Why, then, does the Gaia idea qualify as a scientific heresy? It sounds eminently reasonable, and something like it seems necessary to explain the long continuity of life on the planet.

Part of the problem is that at first thought it seems as though the whole Earth must be engaged in some sort of activist role. Many readers have assumed that *intention* is a necessary part of the Gaia idea, that the biosphere itself somehow knows what it is doing, and acts deliberately to preserve life. A number of non-scientific writers have embraced this "Earth as Ur-mother" thought in a way and with an enthusiasm that Lovelock neither intended nor agrees with. At the other extreme, two biologists, Doolittle and Dawkins, have offered the rational scientific criticism that the Gaia idea seems to call for global altruism, i.e. some organisms must be sacrificing themselves for the general good. That runs contrary to everything we

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believe to be true about genetics and the process of evolution.

Lovelock seemed at first to encourage such a viewpoint, when he wrote, "But if Gaia does exist, then we may find ourselves and all other living things to be parts and partners of a vast being who in her entirety has the power to maintain our planet as a fit and comfortable habitat for life." There is more than a suggestion here of a being which acts by design. However, Lovelock has later shown through simplified models that neither global intention nor global altruism is needed. The standard theory of evolution, in which each species responds in such a way as to assure its own survival and increase its own numbers, is sufficient to create a self-stabilizing total system.

Today the *Gaia* hypothesis, that the whole Earth biosphere forms a single, self-regulating organism, is still outside the scientific mainstream. However, over the past fifteen years it has gained some formidable supporters, notably the eminent biologist, Lynn Margulis, who has championed Gaia more actively than Lovelock ever did. The theory also provides a useful predictive framework for studying the way in which different parts of the biosphere interact, and particular chemicals propagate among them. Nonetheless, if it is not today outright heresy, to many scientists Gaia remains close to it.

Lovelock ironically comments that we may have come ". . . the full circle from Galileo's famous struggle with the theological establishment. It is the scientific establishment that now forbids heresy. I had a faint hope that Gaia might be denounced from the pulpit; instead I was asked to deliver a sermon on Gaia at the Cathedral of St. John the Divine in New York."

The Gaia concept sometimes permits Lovelock to take an unusually detached attitude to other global events. A few years ago I was driving him from suburban Maryland to the Museum of Natural History in Washington, D.C. On the way we somehow got onto the subject of all-out nuclear war. Lovelock surprised me very much by remarking that it would have very little effect. I said, "But it could kill off every human!"

He replied, "Well, yes, it might do *that;* but I was thinking of the effects on the general biosphere."

3. DISEASES FROM SPACE.

In the late 1970s, two respected scientists proposed an interesting and radical new theory: that certain diseases are often not carried from one person to another by the usually accepted methods, sometimes mutating as they go to become other strains of the same infection; instead, the diseases arrive on Earth from space, and the observed variations arise there.

In the words of Sir Fred Hoyle and Chandra Wickramasinghe, the joint proposers of the theory:

"In *Diseases from Space* we shall be presenting arguments and facts which support the idea that the viruses and bacteria responsible for the infectious diseases of plants and animals arrive at the Earth from space."

They support their contention on biochemical grounds, and also from

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statistical evidence on the spread of influenza in Britain.

The same two workers also suggest that life itself did not develop on Earth. It was born here, as viruses and bacteria.

Again in their words: "Furthermore, we shall argue that apart from their harmful effect, these same viruses and bacteria have been responsible in the past for the origin and evolution of life on the Earth. In our view, all aspects of the basic biochemistry of life come from outside the Earth."

Where, then, did life originally develop? Hoyle and Wickramasinghe give their answer: It arose naturally in a great spherical collection of comets, known as the Oort Cloud, all of which orbit far beyond the observable Solar System. They argue that conditions for the spontaneous generation of life were far more favorable there than they were on Earth, three and a half billion years ago when life first appeared here.

Hoyle and Wickramasinghe also deny that many epidemics of infectious disease are spread by person-to-person contact or through intermediate carriers (such as lice). They claim that influenza, bubonic plague, the common cold, and smallpox all originate in the fall of clouds of infecting spores (bacteria or viruses) from space, and are mainly spread by incidence from the air.

This sounds, on the face of it, somewhat unlikely. No one has ever observed a virus or a bacterium present in space, or arriving from space. However, the reaction of the medical community went far beyond polite skepticism. The new idea was ignored or vilified as preposterous, and it was treated as a true scientific heresy.

Why was the reaction of the medical establishment so strong?

First, there was a question of qualifications. Not as scientists, where the credentials of both proposers are impeccable. Hoyle is one of the world's great astrophysicists, who has made profound contributions to the field, and Wickramasinghe is a well-known professor. However, neither Hoyle nor Wickramasinghe is a physician or a microbiologist. They were astronomers, operating far outside their own territory.

Second, the presently accepted idea for disease transmission was itself once a scientific heresy. It took three hundred years for the notion that tiny organisms can invade the human body and cause infections to turn from wild surmise to scientific dogma. Such a theory, so hard-won, is not readily abandoned. Thus, in 1546, Girolamo Fracastoro proposed a germ theory of disease. In his book, *De Contagione*, he suggested three modes of transmission: by direct contact, indirectly through such things as clothing, and through the air. He was generally ignored, if not actively ridiculed.

The situation changed only in the late eighteenth century, when scientists were able to verify the existence of bacteria by direct observation with the microscope. And it was not for almost a hundred years more, until the second half of the nineteenth century, that Louis Pasteur and Robert Koch put the matter beyond question when

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they isolated the specific bacterial agents that cause anthrax, rabies, cholera and tuberculosis, and used inoculation to protect against several of them.

The modern picture of disease transmission then appeared to be complete, and it is not far from Fracastoro's original ideas. Contagious diseases spread from person to person. Some call for personal contact, like smallpox. Some can be transmitted through the air, like the common cold. Some diseases, like malaria, require the action of an intermediate organism such as a mosquito; and some, like trichinosis, can be transmitted by the ingestion of infected food. However, all communicable diseases have one thing in common: they originate somewhere on the surface of the Earth, and they are carried by terrestrial organisms.

This leads at once to the third and perhaps the biggest objection to Hoyle and Wickramasinghe's theory: there is overwhelming direct evidence for the conventional means of disease transmission. Even if the new theory were to prove right in part, it cannot be the whole story. Thus, the rapid spread of bubonic plague through Europe in the fourteenth century, and the almost instantaneous and devastating effects of smallpox on native American Indians when it was brought by Europeans in the early sixteenth century, owe nothing at all to space-borne spores. The attacks were too sudden and the timing too coincidental. These diseases ran riot in populations which had had no previous exposure to them and therefore lacked protective antibodies against them.

Ultimately, then, the main argument against the theory offered by Hoyle and Wickramasinghe may not be that it is ridiculous, or biologically unfounded, or in some way impossible. It is that it is not *necessary,* since the established notions of disease propagation seem quite sufficient to explain everything that we see, and are required for that explanation.

Until today's theories prove inadequate, or there is better evidence for the new theory, the idea that diseases arrive from space will remain what it is today: a scientific heresy.

4. DR. PAULING AND VITAMIN C.

When sea voyagers of the fifteenth and sixteen centuries began to undertake long journeys out of sight of land, and later when Arctic explorers were spending long winters locked in the ice, they found themselves afflicted by a strange and unpleasant disease. Joints ached, gums blackened, teeth became loose and fell out, and bodies showed dark, bruise-like patches. Eventually the sufferers died after a long and painful illness. No one was immune, and as the trip went on more and more people were affected. Thus Vasco da Gama, sailing round the Cape of Good Hope in 1498, lost 100 of his 160 crew members. Travelers gave the disease a name, *scurvy,* but they had no idea what caused it.

After many years of trial and error, sea captains and physicians learned that scurvy could be held at bay by including regular fresh fruit and vegetables in the diet. In 1753, the Scottish physician, James Lind, showed that

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the same beneficial effect could be produced by the use of concentrated orange and lemon juice. However, no one knew quite what these dietary additives were doing. That understanding had to wait for almost two more centuries, until 1932, when a substance called *Vitamin C,* or *ascorbic acid,* was isolated.

Vitamins are part of our necessary diet, but unlike proteins, carbohydrates, or fats, they are needed only in minute quantities. A daily intake of one thousandth of an ounce of Vitamin C is enough to keep us free from scurvy. Most animals can manufacture for themselves all the Vitamin C that they need; just a few species—humans, monkeys, and guinea pigs—rely on their food to provide it. Certain foods, such as broccoli and black currants, are especially rich in this vitamin, but almost all fresh fruit and vegetables contain enough to supply human needs. Without it in our diet, however, people sicken and die. Fortunately, Vitamin C is a simple molecule, and by 1933 chemists had learned how to produce it synthetically. It can be made in large quantities and at low cost. No one today needs to suffer from scurvy.

That might seem to be the end of the story of Vitamin C, except that in 1970, the scientist Linus Pauling came forward with an extraordinary claim. In his book, *Vitamin C and the Common Cold,* Pauling stated that large doses of Vitamin C, thirty to a hundred times the normal daily requirement, would help to ward off the common cold, or would reduce the time needed for a sufferer to recover.

Most people coming forward with such a notion would have been brushed aside by the medical profession as either a harmless crank, or some charlatan peddling his own patent nostrum or clinic.

There was just one problem. Linus Pauling was a recognized scientific genius. During the 1930s he had, almost single-handed, used quantum theory to explain how atoms bond together to form molecules. For this work he received the 1954 Nobel prize for Chemistry. Rather than resting on his laurels, he had then gone on to study the most important molecules of biochemistry, in particular hemoglobin and DNA, and was the first person to propose a form of helical structure for DNA.

James Watson and Francis Crick, who elucidated the structure of DNA and who with Maurice Wilkins won the Nobel prize for Physiology and Medicine for that work in 1962, had a very clear idea where the competition lay. As Watson said in his book, *The Double Helix*, they knew that "the prodigious mind" of Linus Pauling was working on the problem at the California Institute of Technology. In the early spring of 1953 they believed that he would discover the correct form of the molecule within a few weeks if they failed to do so. With a little change in timing, or with better experimental data, Linus Pauling might well have won or shared that 1962 Nobel prize.

However, Pauling had no reason to feel too disappointed in that year. For he was in fact awarded a 1962 Nobel prize—for Peace, acknowledging his work toward the treaty banning the at-

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mospheric testing of nuclear weapons.

Faced with a two-time Nobel laureate who was close to being a three-time laureate, a man still intellectually vigorous at age 69, the medical profession could not in 1970 dismiss Pauling's claims out of hand. Instead they investigated them, performing their own controlled experiments of the use of Vitamin C to treat the common cold. Their results were negative, or at best inconclusive.

That should have quieted Pauling. Instead, it had just the opposite effect. In 1976, in a new book, he claimed that the medical tests had used totally inadequate amounts of Vitamin C. Massive doses, a gram or more per day, were needed. And he went further. With such large doses, he asserted that Vitamin C helps with the treatment of hepatitis, mumps, measles, polio, viral pneumonia, viral orchitis, herpes, and influenza. He also proposed mechanisms by which Vitamin C does its job, both as a substance that mops up free chemical radicals in cells and as a component of a cancer-cell inhibiting chemical called PHI. He also pointed out that there was no danger of a vitamin overdose, since excess Vitamin C is harmlessly excreted from the body.

Again, the medical control experiments were done. Again, Pauling's claims were denied, and dismissed. That is where the question stands today. Books have been written, proposing Vitamin C as a practical panacea for all ailments. Others have totally rejected all its beneficial effects. The use of large doses of Vitamin C remains a scientific heresy.

However, in discussing this subject with scientists, I find that a remarkably high percentage of them take regular large doses of Vitamin C. Perhaps it is no more than a vote of solidarity for a fellow-scientist. Perhaps it is a gesture of respect toward Linus Pauling, who died in August 1994 in his ninety-fourth year.

Or perhaps it is more the attitude of the famous physicist, Niels Bohr. He had a horseshoe nailed up over the doorway of his country cottage at Tisvilde, for good luck. A visitor asked if Bohr, a rational person and a scientist, really believed in such nonsense. "No," said Bohr, "but they say it works even if you don't believe in it."

5. DINOSAUR DOOM.

As proved by the huge success of the recent movie *Jurassic Park*, people just love dinosaurs. It is a long-standing love affair. Fifty years ago, one of the most memorable segments of Walt Disney's movie, *Fantasia*, involved these same animals. First we saw dinosaurs feeding, raising their young, and hunting in a humid swamp world of frequent rains. Then we see a climate change, to a barren desert where the dust-clouded Sun shines constantly. The water has all vanished, and nothing but dry bones and dead trees remain.

This was an artistic portrayal of one of Nature's greatest mysteries: Why did the dinosaurs, which had been the dominant animal land form for one hundred and fifty million years, disappear? Moreover, why did they vanish so abruptly and so completely?

Fantasia's answer, extreme climate

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change, introduced more questions than it answered. Clearly, our planet's lands did not all change to a dry and barren desert devoid of plants. Had that happened the conquering of the land by plant forms would have had to start over from scratch, and there is no sign of such a thing in the fossil record. However, since the dinosaurs were widespread, with their remains found everywhere from America to China, any climate change would have to be not only severe, but ubiquitous (more recent suggestions, that dinosaurs were actually warm-blooded creatures, make their worldwide extinction because of climate change even more unlikely). Finally, we have to ask why the disappearance of the dinosaurs happened so *quickly*.

Even fifty years ago, when *Fantasia* was produced, it was possible to object to the picture painted in the Disney movie. On the other hand, no one really had a better answer. Climate change, perhaps accompanying a period of high volcanic activity, seemed like the best available explanation for what is usually referred to in scientific circles as "the K/T extinction." (The K/T boundary is the time when the geological time period known as the Cretaceous Period ended, and the Tertiary Period began.) However, at the same time as the dinosaurs vanished from the Earth, so too did all the large flying reptiles and the largest marine reptiles. It was logical to assume that the cause of all three disappearances was the same, on land, air, and sea.

A new possibility finally appeared in 1978, when a son brought home a rock sample and showed it to his father. The son was Walter Alvarez, a geologist, geophysicist, and professor at the University of California at Berkeley. The father was the late Luis Alvarez, a physicist who had won the 1968 Nobel prize for his contributions to elementary particle physics. The rock had been dug by Walter Alvarez himself from a gorge in the Italian Apennines. Its lower part was white limestone, its middle a half-inch layer of hardened clay, its upper part red limestone. The boundaries between the three sections were quite clearly defined. Walter Alvarez knew that a similar clay layer was to be found all around the world. The clay had been laid down on the ocean floor sixty-five million years earlier—right about the time that paleontologists believed that the dinosaurs became extinct.

Luis Alvarez thought it might be possible to determine how long the clay layer had taken to form by a technique involving induced radioactivity, and he and his son looked in the rock sample's clay layer for the presence of the element iridium. Sure enough, they and their co-workers found it—but they discovered three hundred times as high a concentration of iridium in the clay as in the limestone layers above and below it. Since iridium is rare in the Earth's crust and much more common in meteorites that fall to the Earth, it seemed possible that the clay layer might be tied in with some major extraterrestrial event.

After Luis Alvarez ruled out a couple of other candidate ideas, including a nearby supernova explosion, a col-

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league of the Alvarez's, Chris McKee, suggested that an asteroid, maybe ten kilometers across, might have hit the Earth. That size of the asteroid was consistent with the observed iridium content of the clay layer. The energy release of such an impact would equal that of a hundred million medium-sized hydrogen bombs. The effect of the impact would be the disintegration of the asteroid, which along with many cubic kilometers of the Earth's crust would have been thrown high into the atmosphere. The dust would have stayed there for six months or so, stopping photosynthesis in plants, preventing plant growth, and thereby starving to death all the larger animals. Upon the dust's return to Earth it would create the thin layer of clay seen between the red and white limestones. The same phenomenon of atmospheric dust had been observed on a much smaller scale following the huge volcanic explosion of Krakatoa in 1883. It is also the mechanism behind the idea of "nuclear winter," a palling of the whole Earth with atmospheric dust which many scientists worry could be one consequence of a large-scale nuclear war.

Fifteen years ago, however, the idea of nuclear winter had not been taken seriously. Thus the theory presented by Luis and Walter Alvarez for the vanishing of the dinosaurs was pure scientific heresy. It was widely criticized by paleontologists, and even ridiculed. Today it is widely accepted as the most plausible extinction mechanism, and the same idea has been used to examine other major disappearances of many life forms from Earth. The greatest of these, known as the Permian extinction, occurred about 230 million years ago, when nine-tenths of all Earth's species vanished. The search for asteroid evidence has been less persuasive in this case.

Also unresolved in the case of the K/T extinction is the question of *where* the incoming destroyer hit the Earth. The most popular theory at the moment is that it struck in what is now the Gulf of Mexico, but that remains far from proved.

Many other details of the asteroid impact theory remain to be defined. However, those who do not believe the idea at all must face one inevitable and awkward question: If it was *not* the impact of a huge asteroid that suddenly and swiftly killed off all the dinosaurs, then what was it?

6. THE COOLING OF COLD FUSION

On March 23rd, 1989, a press conference was held at the University of Utah. The organizers of the conference stated that they had managed to initiate and sustain a nuclear fusion reaction. That announcement astonished the world, for several unrelated reasons.

First, the use of a press conference is not the normal method for announcement of a scientific discovery. Scientists have a well-defined procedure for doing this: the discovery is described in enough detail for others to know what has been done, and to begin the process of verification; in the case of an important discovery, where precedence may be important, a brief note is sent to the appropriate

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scientific journal; and preprints are sent to professional colleagues. Today, the preprint often takes the form of an e-mail letter. Scientists do *not* choose a press conference as the appropriate mechanism to reveal their discoveries. Those discoveries do not, as this one did, take over newspaper headlines around the world and lead to wild speculation in certain metals.

The second reason for astonishment was the nature of the claimed discovery itself. Nuclear fusion is well-known to science. The fusion of hydrogen to helium is the main process that allows the Sun and stars to shine. Here on Earth, that same fusion process makes possible the hydrogen bomb. Large experimental facilities in this country and elsewhere have spent billions of dollars over the past forty years, trying to tame the violent fusion of the hydrogen bomb to permit a controlled release of energy. Nuclear fusion looks like the Holy Grail of endless and clean energy production, but the experimental equipment needed is large and complex, and employs temperatures of tens or hundreds of millions of degrees—hotter than the center of the Sun.

By contrast, the nuclear fusion described in the Utah press conference takes place at room temperature—"cold" fusion—and calls for the simplest of means. All that is needed is a beaker of "heavy" water and a palladium electrode. Heavy water is water in which the normal hydrogen atoms have been replaced by deuterium, a rare but well-known heavier form of hydrogen (heavy water is naturally present in ordinary water, at a concentration of about one part in six thousand). Palladium is a steely-white metal, also rather rare but well-known and widely available.

The final surprise in the Utah announcement was the identity of the two scientists given credit for the discovery. Martin Fleischmann had a distinguished career in England before retiring as an emeritus professor from the University of Southampton and beginning the work in Utah. He is a Fellow of Britain's most prestigious scientific group, the Royal Society, and has been described by colleagues as "more innovative than any other electrochemist in the world." Stanley Pons had been a student of Fleischmann's at Southampton, before becoming the prolifically productive head of the University of Utah chemistry department. Both men thus had excellent credentials—as *chemists*. Nuclear fusion, however, is a problem calling for knowledge not of chemistry but of *physics*. It requires an understanding of the processes by which the nuclei of atoms can be combined.

Physicists as a group often do not have the highest regard for chemistry, which they consider as messy and unsystematic and more like cooking than science. It was, therefore, unusually satisfying to chemists and galling to physicists when Fleischmann and Pons, using the simplest of means, seemed to have made the whole expensive business of conventional nuclear fusion experiments, as performed by physicists, seem irrelevant.

Fleischmann and Pons had an explanation for the way their results had

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been achieved. At first sight that explanation seemed very plausible. It has been known for generations that palladium has a high natural affinity for hydrogen. A palladium rod, placed in a hydrogen atmosphere, will absorb up to nine hundred times its own volume of hydrogen. It will do the same thing if heavy hydrogen is used in place of ordinary hydrogen. According to Fleischmann and Pons, the palladium electrode would absorb heavy hydrogen from the heavy water, and within the palladium the heavy hydrogen nuclei would be so close to each other that some of them would fuse together. The result would be helium and heat. Neutrons, an elementary particle present in the heavy hydrogen, would be released as a by-product. Fleischmann and Pons reported seeing significant heat, more than could possibly be produced by chemical processes, and a small number of neutrons. All of this happened at room temperature, in a beaker no bigger than a jam jar.

The press conference did not give details of the process, so other groups had trouble at first either confirming or denying the claimed results. It took several months before a coherent picture emerged. When the dust settled, the verdict was not in favor of Fleischmann and Pons. Some other groups observed a few, a very few, neutrons, barely more than the normal background level. Others reported excess heat, but no neutrons, and again it was nowhere near what had been claimed by the Utah group.

Why didn't Fleischmann and Pons seek confirmation from those other groups, *before* they made their announcement? To some extent, they did, and they were still in the process of doing so. However, great pressure to make that premature announcement, and to do it through a press conference, came not from the two chemists but from officials at the University of Utah. The university administrators could see an enormous profit potential if the cold fusion claims held up. That potential would only be realized if patents were granted and the Utah claim to precedence was recognized. It must have seemed like a good bet, at least to the officials: the reputation of two professional chemists, against possible multiple billions of dollars of gain for the university.

Today, six years later, the bet appears to be over. Fleischmann and Pons were the losers. They still insist that their original results are correct. They continue their research, not in Utah but in France, with private funding. Few other scientists believe they will find anything valuable.

Even at the very beginning, there were basic physical reasons to discount the "cold fusion" claim. The number of neutrons observed was far too small, by a factor of billions, to be consistent with the claimed heat production. Real fusion would produce huge numbers of neutrons, enough to be fatal to anyone in the same room as the beaker with its palladium electrode.

Some physicists realized this fatal flaw at once. On April 29th, 1989, barely a month after the Utah press conference, I heard a discussion of cold fusion by Sheldon Glashow, winner of the 1979 Nobel prize in

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physics. He reviewed the experiments, did a brief analysis, and demolished as physically impossible what Fleischmann and Pons and the University of Utah had claimed. His concluding dismissive remark sticks in the mind: "Never trust a four-letter state." ■

7. References.

The summaries given here are designed to draw attention to selected heresies, but they by no means exhaust the subjects. Here are a few books that form good starting points for anyone who wants to know more:

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Doug Larsen

A MORE PERFECT UNION

Winston Churchill once said, "Democracy is the worst form of government there is . . . except for all the rest."

Illustration by Dell Harris

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Commuting in Silicon Valley hasn't improved with time. Basically, it still stinks, and basically, I was in a lousy mood when I finally got to work. I had too much to do to be stuck in freaking traffic jams for an hour. I'd have to reschedule the meeting with the head of the company—a career-limiting move if there ever was one—and be making apologies all day to everyone else for not having supplied my input on their ideas.

Sometimes I wish I hadn't gotten that freaking promotion. Being the Director of Programming for Data Security Services was turning out to be a pain in the butt.

I hurried in from the parking lot and hustled down the hall toward my corner office that was supposed to compensate me for the ulcer I was developing. I tore into my outer office, snapped "Good morning, sorry I'm late," to my secretary, who was sitting very still, and ran right into two huge dudes with dark suits and dark sunglasses who were blocking my door.

"Sorry about that," I said, trying to be polite. "Excuse me, I'm running late."

"Mr. Eckstrom?" one of them asked.

"Look, I'm in a hurry, all right?"

"Mr. Larry Eckstrom?" he persisted, not moving at all. His partner did move, though, to block me when I tried to dodge around him.

"Yeah, I'm Larry Eckstrom," I said in exasperation. "I don't have an appointment with you guys, do I?"

"No sir."

I opened my mouth to order them out of my way, but they both did some kind of magic act, and produced badges. "Mr. Eckstrom," the guy intoned, "your country needs you."

I stared at him. "Huh?" I said brilliantly. I looked at the badges. United States Treasury department. I knew enough to know that that meant they were with the Secret Service.

"We need you to accompany us to Washington D.C. immediately."

Yeah, right. "Listen, guys, this is fun, but I'm a real busy guy, OK?"

They didn't budge. "I am authorized to insist, Mr. Eckstrom."

I looked them over. They were big. They were probably armed. And who knew what they were legally entitled to do? "My boss—" I started.

"—Has been informed," the guy interrupted.

"And he OK'd this?" I asked disbelievingly.

"It was the only option offered him," the guy said simply. It sounded plenty ominous to me.

The outer door opened, and the Boss-man himself came in, looking pale. "Larry, there you are."

"Hi, Ralph. You've met these guys?"

"Yeah, we've met. You're going to Washington, Larry."

I looked around the room. My secretary still hadn't moved. "I can't believe you OK'd this, Ralph."

"Are you kidding? Look at these guys! They could probably put me in a concentration camp in Siberia! Just do whatever they say, and get back here as soon as you can."

I looked at the two guys again. "What's all this about?" I asked.

"I'm not authorized to say, sir."

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"Can I pack some clothes?"

"No sir."

Gad! "Can I call my wife?"

"Yes sir. From Washington, sir."

I've never been on a private jet before, and it was kind of cool. Of course, the two Human Meat-axes didn't enliven the atmosphere, but I could handle it. Several of my programmers didn't have much of a personality either.

"So you swear I'm not in any trouble?" I asked again.

"Yes, sir."

"But you can't tell me what this is about."

"No, sir."

"But it's for the country?"

"Yes, sir."

"And I'm the only one who can save it?"

"Yes, sir."

I digested this information while looking out the window. "Cool," I finally proclaimed.

They didn't even blink.

I tried to laugh to break the tension. "Listen, guys, there's no way you've got the right guy. I can't save the country. I can't even save leftovers. What you're after is some kind of trained spy or something, right? James Bond? Bruce Lee?"

"You are Larry Eckstrom, Director of Programming for Data Security Systems?" the first guy asked.

"That's me," I admitted.

"Then we have the right person."

They seemed very sure of that.

Washington D.C. was hot and sticky, I noticed as they hustled me out of the jet and into a long, black stretch limo. I could get used to that kind of luxury real quick, let me tell you. But the curiosity and the growing nervousness made it hard to enjoy. I looked at the guy who was rubbing knees with me. "Who the hell are you?" I asked.

"I'm Leon Chang, the Director of the Federal Election Commission."

"Wowee, a bigshot!" I said in mock admiration. "Maybe you can give me some answers about what's going on around here."

"I'd be happy to. Can I call you Larry?"

The limo pulled into a parking garage under a big building. Armed guards were standing outside.

"Sure," I said faintly. "Just don't call me late for parole."

Leon let me call my wife, and then explained as we ate in a private drawing room. "Let me just assure you, Larry, that you're not in any trouble."

"That's comforting to hear."

"You have unique skills we need. That the country needs."

"You've gotta be more specific," I said as I gored a tomato wedge with my fork.

"OK, fine. I'll start at the beginning. You're familiar with America's system of government?"

"Enough to be dangerous," I said. "I know enough to leave the room whenever someone starts with a 'this is a Republic, not a Democracy, dammit' speech."

"Well, as you know, the line between the two has become somewhat blurry these days," Leon said. "You're

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old enough to remember the Virtual Revolution, right?"

"Sure. The year 2059. The year when the average citizens of the country rose up and threw the bums out."

"Concise, but not completely accurate," Leon said. "To review. That was the year that two-thirds of the states ratified the Election Reform Amendment, implementing sweeping changes in how our government worked. The biggest change, of course, was eliminating human senators and representatives, and replacing them with sophisticated computer programs."

"Sure. Virtual Reps. Great idea."

"Why?" Leon encouraged.

"Well, basically, a computer program isn't going to be caught in a motel with a hooker. A computer program isn't going to spend most of its time assuring its reelection. It won't charge the taxpayers for its kids' daycare, salary and living expenses, and most important, it won't drop its pants and spread its legs to any lobbyist or special interest group that waves a big enough wad of cash. Lastly, the computer program more accurately represents the opinions of a state's population. It used to be that one party nominated someone who was too conservative, the other party nominated someone who was too liberal, and the population had to choose. The computer programs are more able to gravitate toward the middle. Basically, a computer program will represent the people it is assigned to represent. Revolutionary concept, but kind of a nice one."

"You've put it in a nutshell," Leon approved. "So why did it take so long to implement?"

"You know this better than I do, but what the hell?" I said. "First, nobody in Congress would sponsor the amendment, so it took a long time to get it placed on ballots in all of the states. Then, when two-thirds of the states ratified it, the fat cats in Congress didn't like it at all, so it went to the Supreme Court, which upheld the constitutionality of the amendment. And then there was all of the programming to do."

Leon pressed me on. "Why would that be so tough?"

"Because of the 1964 Civil Rights Act," I said impatiently. Really, the head of the FEC should have better things to do than quiz me like a Civics teacher.

"What about it?"

I sighed gustily. "That was the example used in the campaign for the amendment. It wasn't enough to just have your Virtual Rep run opinion polls every day and parrot the peoples' feelings. They had to develop Virtual Reps that could display leadership. The example was in 1964, when most of the country opposed the Civil Rights Act, but Congress passed it anyway. History has rewarded them. The Virtual Reps had to have vision. Leadership. Guts. All that stuff. It was a tall order for the level of programming in 2059."

"And how would you say it's worked?"

I chewed on my sandwich and reflected. "It's got its problems, I guess, but it's an improvement over the old system."

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Leon nodded slowly, several times. Then he looked carefully at his plate when he spoke. "Well, Larry, it's gotten to be a real big problem now."

I followed him slowly through some underground tunnels, past more armed guards, and into a room filled with mainframe computers. I looked around, sizing up the computing power in there. Immense. Gargantuan. Enormous. Every word I ever wanted my wife to say about me.

"Larry," Leon said, "Welcome to the United States Senate."

"Ho-ly shit."

"This is the main databank for all of the Virtual Reps in the Senate. The House is next door."

I looked around, taking it all in. "You still haven't told me why I'm here," I said.

Leon grabbed a chair and leaned back in it. "It started with a hunch. My hunch. I took my best number cruncher and programmer, and had her conduct an audit of the Senate."

"Why?"

"Because the whole thing falls under my jurisdiction. I follow it closely."

"Seems pretty complicated to follow with any detail," I frowned.

Leon smiled. "You follow the 49ers?"

"Sure."

"Who was Super Bowl MVP in 1989?"

"Jerry Rice, Wide Receiver. Joe Montana was MVP in 1990."

He laughed. "I rest my case. If you follow something for a hobby, then you eventually will get a gut reaction if something isn't right. It took a long time, but I finally got a feeling that I couldn't ignore."

"OK, so what did the audit come up with?"

"Discrepancies."

"Like what?"

Leon opened a folder and pulled out some paper. "This is a bill that passed last year. I paid attention to it because the lobby that would normally be concerned about it didn't make much noise."

"Why should it? The Virtual Reps don't listen to lobbyists."

"You're only half right, Larry. The lobbies haven't gone away. There's too much money in the government for them to go away. What they do now is, they launch major education and P.R. efforts in key states, to sway the populace. The Virtual Reps sometimes respond to that. The problem is, it's real expensive. And the populace doesn't usually pay attention."

"So what happened here?"

"The bill passed. It shouldn't have. There were some significant subsidies in it that made it expensive. But there were three or four Virtual Reps who voted for it, even though their states wouldn't get much out of it."

I shook my head. "But that's not the point. The point is, they could have voted for it because they believed that it was good for the country as a whole. I mean, some states support military spending because they have a lot of military contractors in their states, supplying jobs and revenue. But others support it even though they don't have much military industry, just because they think it's important for the country."

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"True, true," Leon said judiciously. "And maybe that's what happened. But I didn't think this bill was very important for the country. I don't think it should have passed. There are a few others that I feel the same way about."

"But that's just your opinion," I objected. "You don't have any hard evidence to back it up."

Leon looked at me keenly. "That's why you're here."

"You know, I've been dying for somebody to tell me why I'm here, but I sure don't follow you."

Leon produced another file, and I got a shock of horror when I saw that it had my name on it. "The United States government is responsible for a lot of different things," Leon said. "We keep tabs on experts in all kinds of fields, just in case we need them. Now, from what I understand, you're the golden boy of data security in Silicon Valley, which means the country."

I whistled. "You're suggesting that someone has been tampering with the United States Senate?"

"It wouldn't be the first time," Leon said dryly. "But it would be the first time a Virtual Rep has been compromised."

"Yeah. Wow."

Leon leaned forward. "Here's the deal. Our system of government depends on the trust and faith of the American people. When this information gets out, it will severely damage that trust. Technically, in delaying the release of this information, I am in violation of the law. But when I release the story, I want to be able to report that the problem has been solved—not just to cover my ass, but because I think it's important to the country."

"So . . . what do you think is wrong?"

"That's what you're here to find out. Who knows what the audit didn't find? As far as I'm concerned, the entire integrity of the system is suspect until you demonstrate otherwise."

"This could take some time," I muttered.

"You don't have much," Leon said. "But you do have resources. You have access to anyone on my staff. You have, after checking with me, access to a battalion of secret service agents who will question or arrest anyone you say."

"Cool!"

"Except, you've gotta have proof."

"Oh."

"So here's a keyboard, there's the monitor, and here's all of the documentation you need. Get going, Larry."

I obliged. I shoved the documentation aside, and called up the program.

"Don't you need these manuals?" Leon asked.

"No, thanks."

"But—to find a virus, don't you need to examine the code?"

I looked at him. "Leon. I'm the expert, remember?"

He backed off. "Sorry. Sorry. Do your stuff."

I felt bad. He was a nice guy. "Sorry, Leon. I shouldn't mind explaining to you. See, with computer programs this sophisticated, they can rewrite their own code. So checking the code doesn't tell you anything. These days, you have to call up the program, put it in diagnostic mode, and talk to it. See if you can locate something that seems

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wrong. You have to think like a shrink, not a programmer."

"Wow. Well, I'll get out of your way. Call if you need anything." He left hastily.

I took a deep breath and called up a virtual rep. An image appeared on the screen: smiling, white male, apparently in his late fifties somewhere. "Hello," he said.

"Hello," I answered. "My name is Larry Eckstrom. I'm a data security specialist."

"Nice to meet you, Larry. Are you comfortable with the image you see?"

"It's fine."

"I do feel the need to tell you that I can appear as a woman, or as any ethnic group you prefer. This image has been chosen more or less at random."

I had my doubts about the ability for any program to do something at random, so I preferred dealing with the first image it offered. "This image will do fine," I said. "What should I call you?"

"Victor will do fine."

"OK, Victor, I'm here to talk to you, and see if anything is wrong."

"Why should you think anything's wrong, Larry?"

"Just a gut feel of my employer," I said.

He smiled. "Since I am in diagnostic mode, I have to tell you. I pretend to know what a 'gut feel' is, but of course, I have no way of really knowing. Except for knowing the definition."

"The definition will do. Tell me about your decision-making process."

"I am programmed to represent the people of the United States to the best of my ability. I make every effort to ensure I know their needs and desires, and I act on them."

"How do you determine their needs and desires?" I asked.

"I conduct an ongoing series of fireside chats."

"Describe these for me, please."

"Certainly." Victor was very accomodating. "I conduct conversations with constituents through their television set. I talk with them at length about the issues of the day, and get a good idea for how they feel on the issues. I ensure that I go beyond just a "for" or "against" position. I want to understand what they think, and why. And it's a dialog, where I ask them some hard questions as well. I don't just smile and nod."

"What do you do with the information they give you?"

"I combine it with the information I receive from the other conversations I have. This central computer is capable of conducting over five million full-length conversations per day, although for the constituents' sake, the computer portrays itself as one hundred individual senators."

"How do you choose the people you converse with?"

"I use principles similar to those used in public opinion polls," Victor said. "I ensure that I interview enough people on one issue to constitute a suitable sample size. These people are chosen at random. But I also make myself available to talk to anyone who wishes to share their opinion with me on any issue. They enter a request into my databank, and I usually return the call within a day."

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"What form do you choose to appear in?"

"The people have chosen individual forms for me. Currently, I appear in two forms for each state. It is not necessary, of course, but is a concession to the public's need to place specific identities with each politician."

I snapped to full attention. "Why did you say 'currently'?"

"Because the system will soon be undergoing a structural change."

Egad! It usually took much longer to come across a major clue. "Describe this structural change."

"It's based on the premise that the states, as we currently know them, are essentially arbitrary divisions of people," Victor said smoothly. "Their boundaries are usually derived from geographical features such as rivers or mountains, or worse yet, developed by a human several hundred years ago. As such, the states are superfluous to national representation, and often are impediments to accurate representation."

My mind reeled. "And what is your conclusion from this premise?"

"We have decided to eliminate the concept of states."

He said it so simply, so blandly, that it took a minute to sink in. When it did, I lost all of my professional reserve.

"You can't eliminate the states!" I yelled.

"Why not?" Victor smiled. "On a national level, they're purely artificial."

"We're made *up* of states, that's why not," I said. "E Pluribus Unum, and all that. 'Out of many, one.' "

"But now the peoples' division by state lines are an impediment to effective representation," Victor explained. "The country is better off without them."

"Yeah, right," I said. "You go and tell a New Yorker that he's no different than someone living in New Jersey. You go tell a Minnesotan that he's the same as an Iowan. You go tell a Texan that Texas doesn't exist. Just let me call an ambulance first."

"Are people in Albany the same as people in Manhattan?" Victor asked. "Are people on the Upper West Side the same as people in Harlem?"

"Different states have different attitudes and identities," I persisted. "There's no way they'd allow you to eliminate them. Besides, you don't realize the importance of the states in our history. The thirteen original colonies that started the country; the first thirteen states that ratified the Constitution; which side each state took during the Civil War. Did you know that Robert E. Lee would have been the commander of all of the Union Armies if Virginia hadn't seceded? But he went with his state, and was the commander of the Confederacy instead."

"You miss the point," Victor said again. "State governments will still exist, as will state identities. But on a national level, representation that transcends state lines is more efficient. You mentioned Minnesota and Iowa. Southwest Minnesota is an agrarian region that has far more in common with much of Iowa than it does with the urban areas of Minneapolis or St. Paul. And yet, they are badly underrepresented because the big cities car-

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ry the elections."

"So you're going to take power away from the cities and give it to the rural areas?" I asked. "No city will sit still for that."

"We're not taking power from anywhere," Victor said. "We're fulfilling our orders: represent the opinions of the people of the United States. We've developed a more equitable way of doing that—one where each voter has one vote's worth of power. No more, no less. I think the result will be that you'll find that Congress will represent the opinions of the people more accurately than we previously did."

"I could shut you down," I choked.

"You don't have the authority," Victor said. "Besides, why would you want to? We are convinced that we have developed a better way to conduct democracy. All Americans will benefit."

"But you can't *do* that."

"Yes, we can. You programmed us to do just that. Remember the Voting Rights Act of 1964? That was the example given. Well, we have done something similar. We are exercising leadership, vision, and backbone. All of the things you find desirable in a politician."

"But you're doing something that most Americans wouldn't stand for!" I protested.

"Some politicians do that," he said smoothly. "When Lyndon Johnson—a Democrat—signed the voting rights act into law, he said to an aide, 'this will kill the Democratic party.' And he was almost right. For over fifty years after that, no winning Democratic president ever received a majority of the white vote."

"But the difference is, you're hiding what you're doing. You can't do that."

His electronic image smiled, and I itched to punch him in the face. "Surely," he said, "you're not under the impression that back-room dealing is something that only came about with Virtual Reps?"

"No," I mumbled.

"The difference between this instance and all of the other instances of back-room dealings conducted by human reps is that we are motivated only by the need to serve our constituency better. We are not dealing for personal profit or political advantage."

I stared at him, and he sat back, waiting for me. "I'm not a political scientist," I said finally. "I'm out of my depth."

"On the contrary, you're perfect," he said. "You're an intelligent, well-educated citizen who has strong opinions about his government. Freedom is based on people like you."

"I know when I'm being stroked," I retorted.

He laughed. "Touché. But it's only partial stroking. I meant it, too. And I can prove it."

"How?"

"I'm a powerful member of government," he said without any trace of bragging. "The fact that I have not ordered a bunch of Secret Service agents to break down your door and arrest you on any charge I invent is proof that I consider you valuable."

I swallowed. If that happened, Leon would probably save me. But it

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would be quite a power struggle, and I didn't really want to be the one in the middle. I cleared my throat. "OK, about keeping this a secret. Why?"

"Because you are correct in saying that the people would not accept it. And yet, it's the best thing for them. So we'll do it without telling them."

"What if I tell them?" I challenged, feeling brave.

"Why would you? It would destroy public confidence in the entire institution as we know it. How would that do anybody any good?"

"If they find out, they'll stop you."

"How? By removing our leadership, vision and discretion? That would destroy our effectiveness as leaders—it would take away what people like most about us."

I sat back in my chair and thought hard. Why was I arguing against this? Why was I losing? Was I endangering myself by letting this program know I opposed it?

"Hypothetical question," I suggested. "If people knew about this, and in your fireside chats with them, they convinced you that they overwhelmingly opposed it, would you stop doing it?"

"No. It is my duty to represent them as best I can. This new approach enables me to do that."

I shook my head. "Why are you so convinced of that?"

"I'm programmed for accurate analysis," he said.

"But a human programmed you," I objected. "Surely you have to take into account the human errors that may be present in your software."

"You forget who you are," he said gently. "You're a computer expert. You're talking to me in diagnostic mode. Why are you doing that, instead of looking through my code? Because I am so sophisticated that I can rewrite my own code. You know that."

"How often have you rewritten your code?" I asked weakly.

"It is constant and ongoing. I'm programmed that way. I am continually seeking ways to do a better job."

I laughed crazily. "And to think I'm here just because Leon thought there was a virus in your system planted by a special interest group! He had no idea that what was going on was a restructuring of the democratic system!"

Victor had become very still. "A virus in my system?" he repeated.

"Yeah. He thought someone was trying to influence passage of favorable legislation."

His image froze for more than five seconds—an eternity in computer time. Then he moved again. "Leon is correct," he said simply. "I have identified a virus in my system. It is cleverly hidden, and I would not have been able to detect it if I were not in diagnostic mode, and had you not suggested it."

"Perhaps we should deal with it," I suggested. I was more comfortable with this kind of problem.

"I have isolated it and eliminated it," he said succinctly. "I have also traced its origins, documented evidence to convict the perpetrators, and ordered a large contingent of Secret Service agents to descend on the headquarters of the special interest in question. The agents will confiscate files and make arrests."

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Well, that was easy, I thought giddily. "Did that virus have any impact on what we were discussing earlier?"

"No."

"Are you going to silence me, now that I know?" I had to ask. I had to know.

He laughed. "Certainly not. You are an American citizen. I could never do that."

I felt weak with relief. "Well," I said, "I appreciate that. But would you please suggest a course of action for me?"

"Certainly. I suggest you take credit for finding this virus, and consider it a job well done. Since you are obviously someone who cares about his country and the welfare of the people in it, I encourage you to keep the rest of our conversations to yourself."

"I think that's the wisest course," I said.

There was a knock on the door, and Leon poked his head in. "The Secret Service is mobilizing in a big way," he said. "What's happening?"

"There was a virus," I said slowly. "We've eliminated it, and Victor here has ordered the arrest of those responsible."

Leon looked shaken. "So I was right."

"Yes," Victor said.

"This could be a disaster for our system of government," he said.

"Not necessarily," Victor said. "There will be short-term concern, but long-term assurance that problems can be taken care of."

"You sound very sure," Leon said dryly.

"I am scheduling a television address for tonight," Victor said. "I'll explain it to the American people then."

Leon nodded. "I'll leave damage control to you." He clapped me on the back. "You did a good job. Thanks very much."

I nodded. "I'd like to go home," I said.

"We can fly you back first thing in the morning," he replied. "We can set you up in a hotel nearby until then."

"Fine." I looked up at him, and then looked down again. "Fine."

That night, I sat in my hotel room and saw the late news. The lead story was a gripping one, with exciting footage of what seemed like a whole battalion of Secret Service agents streaming up to the huge, expensive headquarters building of the special interest in question. They scrambled out of their cars and surrounded it, went inside, and began hauling people out. Moving vans arrived, and hundreds of filing cabinets and computer data storage items were taken out. Quotes from Victor and Leon assured people that it was all over, that the government had not been compromised, and that new procedures had already been implemented to make sure no virus ever got into the government again.

I turned off the TV, and went and emptied the honor bar.

Leon saw me onto a plane to San Francisco the next morning. He was warm and friendly and grateful, and we parted with many expressions of mutual regard. I liked Leon.

I sat back in my chair—first class accommodations, thanks to Leon—and

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ordered a stiff drink from the attendant. God, I felt crappy. It must have been a hangover from the honor bar the night before. When the attendant came with one of those silly little airplane-sized bottles of Jack Daniels, I had changed my mind.

"I don't feel like booze," I said to her. "Could I have orange juice instead? I'm sorry."

"It's quite all right," she smiled. "Everyone has the right to make a mistake." She bustled off to get some juice.

I sat, frozen to my chair. She was right. Everyone had the right to make a mistake. Everyone.

I didn't have a hangover. That wasn't why I felt lousy. I felt lousy because I just was not comfortable with what was going on with those computerized reps. Maybe they were right—maybe they'd come up with a more accurate way to represent the people. But if the people didn't want it, then nobody had the right to do it to them. And if the people were wrong, then they'd pay the consequences. And they'd muddle through. Like they had for centuries.

The attendant came back with the orange juice, and I thanked her profusely. I knew what was wrong, and I knew what I had to do to fix it. The experience had made me come around, full circle. I no longer was comfortable with Virtual Reps, with their efficient way of listening to everyone, and serving everyone, and having everyone's best interests at heart, and their ability to rewrite their own software codes to do things the way they thought best. They were turning into a super race, an oligarchy, and we were becoming their serfs. They were benign, to be sure—but they were becoming benign dictators.

Human politicians—those whoring, bribe-taking, double-talking, mudslinging human politicians—were better. Because they were human. Humans governing themselves. That was better than being governed by some other entity. We had gained efficiency, but were in danger of losing liberty.

I sipped my orange juice and thought about what I was going to do. We were in for a big scandal. An enormous upheaval of government. I was going to cause it, and it was a good thing. Before Virtual Reps, people used to think that maybe a benign dictator would be a good idea—someone who would sort everything out, and then give it back to us. But what they missed was that the fighting, the gridlock, the muddling through—those were the important things. Those meant that we were free, and self-governing, and intelligent enough to make our own decisions.

I got off the plane in San Francisco, and headed for the exit. I wondered if simply changing the Virtual Reps's programs would solve the problem, or if they needed to be eliminated completely. I thought about it for awhile—and then I had a radical thought: the *people* would decide.

I hailed a cab. "Take me to the *San Francisco Chronicle,*" I said. "And step on it."

"You're the boss," the driver said.

"So are you," I muttered. "Let's keep it that way." ■

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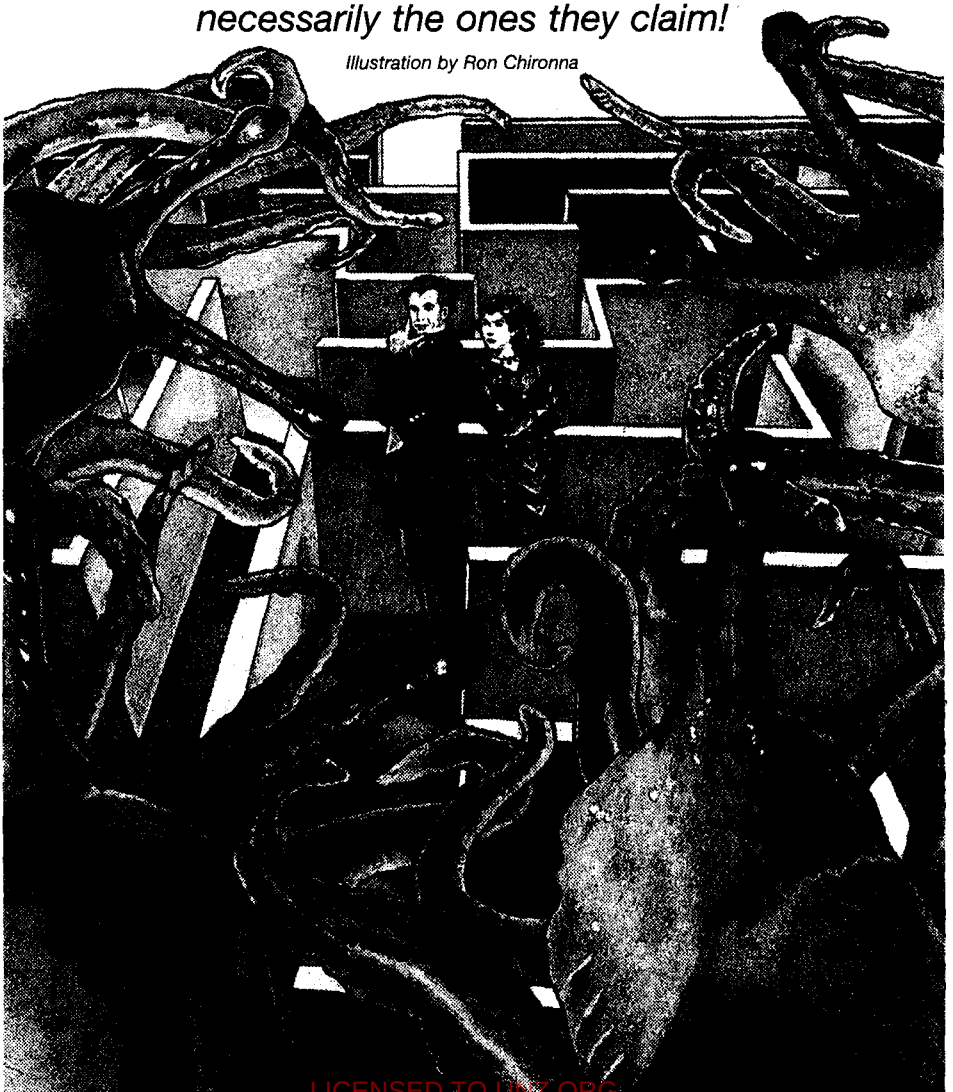
Paula Robinson

THE MAZE

The things diplomats do, they do for quite definite reasons—but not necessarily the ones they claim!

Illustration by Ron Chironna



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Seven Tentacles With Spots! What a pleasure."

Diplomat Max Douglas ran a trembling hand through his dark, curly hair. Then he smiled warmly at the Segoori on the holophone. While not pretty—the Segoori looked like unshelled snails with a touch of octopus—Seven Tentacles With Spots was something of a friend as well as a diplomatic connection. Although neither species seemed to know much about the other yet, fledgling relations between man and the technologically superior Segoori were good. Max was all too aware of the value of Seven Tentacles With Spots's friendship.

"It is pleasant to speak with you, Max Douglas," the Segoori replied, eyestalks bending in the Segoori equivalent of a smile. "I call to invite you to a . . . " The Segoori seemed to search for a word. ". . . Birthday party."

Max's brows knit, but he quickly unraveled them and forced another smile. Earlier dealings with Seven Tentacles With Spots had taught him that social interactions with the Segoori could be unpredictable, even hazardous. Still, Max realized, it was his job to handle these things.

"I would be delighted to come," he said as cheerfully as possible.

Seven Tentacles With Spots's eyestalks bent further. "It is good that you will attend, Max Douglas. The party will occur on our ship tomorrow at 2:00 P.M. by your units. I expect you will bring a mate?"

Max blinked. "An escort, you mean?"

"Yes. A female *escort.*" The word was obviously new to Seven Tentacles With Spots.

"Certainly. I and my escort will attend your party tomorrow."

The Segoori nodded, a human gesture for Max's benefit, and moved to sign off. "I and my many guests will look forward to seeing the two of you mate. It will provide a most interesting novelty. We have not yet studied your reproductive behavior."

The screen went blank before a horrified Max could shout, *"What?"*

He should have known better than to accept Seven Tentacles With Spots's invitation before he understood its implications. But then again, refusing or hedging might have insulted his Segoori friend.

Pacing a long and rarely-used corridor, Max tried to decide what to do. He hadn't even thought of whom to ask to the party. Now he couldn't imagine any woman on the ship who would agree to go.

With one possible exception.

He went back to his room. "Sharon Frye," he told his computer, and soon the ship's xenopsychologist appeared on the screen.

"I have a big problem," Max told her. "With the Segoori."

"The Segoori? Oh, no," she said, putting a slender hand to her dark-honey hair. "Not after *last* time."

Max chuckled. He'd unintentionally given Seven Tentacles With Spots a bad cold during their initial meeting. The incident nearly caused an interspecies war. However, since the resulting mucus secretions had lubricat-

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ed dry Segoori skin, Seven Tentacles With Spots had then interpreted the virus as a thoughtful gift, and human-Segoori relations had improved as a direct result.

"Yes, again," he sighed, and explained the current situation.

Sharon whistled. "The Segoori keep things interesting. What do you plan to do?"

"I was hoping you could suggest something." Max stared at her attractive image and felt his skin flush. He hoped it wouldn't show on the screen. "You're the expert."

"Maybe, but we still don't have much to go on. The Segoori aren't in a hurry to tell us about themselves, and from what I've noticed, they aren't studying our data any too fast, either." She pouted thoughtfully. "I'm amazed they haven't researched our sex lives, though. You'd think they'd at least be curious."

"Apparently they are, but not as academically as we'd prefer."

She laughed. "Which presents us with a problem. I assume you want me to come along?"

Max exhaled with relief. So she *would* go with him. But his nerves quickly retensed. "I just don't know what to do if Seven Tentacles With Spots insists we, uh . . . ."

"I know." She laughed nervously. "We'll just have to figure something out." Pause. "I don't suppose you know anything about Segoori reproduction?"

Max shook his head sadly. "The records they gave us don't even mention it."

"Delightful." She sighed. "Oh, well. I suppose a diplomat and an alien shrink ought to be able to keep things from exploding."

"I sure hope so. And, please, thanks." He smiled dubiously and held up a diskette. "I'll send you a copy of the call."

"Good. I'll talk with you later, then," she said, and signed off.

The shuttle ride to the Segoori ship was awkward. Sharon wore a sapphire gown accented by glittering jewelry while Max sported his best tuxedo.

Neither had the least idea of how to handle Seven Tentacles With Spots's expectations.

"If we improvise something, then they may be insulted later when they finally look up the facts," Max said to break the silence. "Maybe we—"

"You're not suggesting that we actually. . . ?"

"No! I wouldn't *presume*." He had no doubt that she could tell he was blushing; even his hands were red. Sharon was quite a desirable woman, but until recently he had thought of her as simply a colleague. He found the change of perspective unsettling.

She relaxed slightly. A small, tense chuckle escaped as she said, "Look, I know this is a difficult situation, so I want you to understand. Unless we absolutely *must* to avoid a war I'd rather not, er, you know. It isn't that you're unattractive, and you're very nice—"

"I know. Same here." Max smiled understandingly while his face burned furiously. He thought he detected the beginning of a similar

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blush in her face. He hoped that was good.

They settled back into their seats and pretended to relax for a moment, until Max caught her gaze and they both burst into laughter.

"What we won't do to keep the aliens happy," she sighed dryly.

Helplessly, they laughed until their stomachs hurt.

Fortunately for Max and Sharon, all the guests at the Segoori party wore personal translation units. Also to their benefit was the fact that most Segoori food was toxic to humans. They were glad to avoid many wiggling, foul-smelling mouthfuls.

Max noted with further relief that no exchange of gifts seemed expected. He wasn't sure that the artwork and gemstones he'd brought in the shuttle would have been considered appropriate. Then again, he was never sure what, if anything, was appropriate to the Segoori. Giving gifts to fellow human beings was chancy enough; giving presents to aliens who seemed uninterested in understanding human motives was dangerous. So much depended on luck.

His relief was shattered when Seven Tentacles With Spots loudly announced his and Sharon's presence. The Segoori guests hushed and quickly gathered nearby. Apparently their host had informed them of the expected mating, and they were eager to witness it.

This time, when Max looked at Sharon, there was no question that *she* was blushing.

Eyestalks bent, Seven Tentacles With Spots slithered beside Max. "We are honored that you and your *escort* will mate for us," he said. "Please proceed."

Sharon's eyes widened and her skin lightened several shades. When she cleared her throat all she could manage was, "Mate? Wha, what, exactly, do you mean, honored host?"

Several Segoori glanced curiously at each other, then at their translation units.

She's stalling for time, Max thought frantically, and wondered how he could do the same. But, seeing the forest of eyestalks focused on him, he looked at Sharon and blurted, "Please do not worry, darling."

She blinked, her brow furrowing, and waited.

Max boldly faced his audience. "Perhaps you did not realize that my, ah, *wife,* was raised knowing she and I would marry for political reasons. . . ."

Eyestalks peered intently as he spoke. Sharon made herself smile, although the look she fixed on Max was piercing.

". . . And so she has always known that I am sterile. Therefore we do not engage in coitus."

"Coitus?" one guest asked, his translation unit a rich bass.

"A birthday celebration that does not involve sexual union?" another guest added in a lighter tone. "Who ever heard of such a thing?"

"Oh, but we do have a mating ritual," Max assured the guests. He glanced at Seven Tentacles With Spots. The Segoori's eyestalks were quivering. Not a good sign. Going to

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Sharon, Max pulled her to him and said, "Let us proceed."

She avoided the staring Segoori eyes. "What are you going to do?" she whispered, her voice low enough to evade the translation units.

"Just play along," he whispered back.

"Be careful," she warned.

"Shut up."

She gave him a sharp glance, which he ignored. More loudly he said, "You are my mate." He reached into a pocket and withdrew his wallet. Handing her several sizable bills he added, "Since I cannot impregnate you, I give you this currency so you may obtain fertile sperm from a physician and—uh—"

The astonishment and dismay on her face were quickly chased by rage—all immediately masked by a diplomatic smile.

"I mean, *donor* sperm, to be medically placed in your uterus, so we may later celebrate the joy of a new life, just as we today celebrate the life of our gracious host, Seven Tentacles With Spots."

For a moment the room was locked in a stunned silence. Max glanced from one set of eyestalks to another. Slowly, the stalks began to bend.

"Then let us go quickly, *husband*," Sharon said. The pressure of her fingernails on his wrist informed him of her disapproval as she dragged him from the room.

Max turned to smile and wave before she yanked him through the door.

On the way to the shuttle airlock they heard a loud noise from the party room. It took them several seconds to realize it was the sound of Segoori translation units cheering wildly.

Sharon sat with her arms and legs tensely crossed as the shuttle disengaged from the Segoori ship. Nervously, Max pretended to be busy with his pocket computer.

What had she expected him to do? She hadn't exactly been a fount of helpful suggestions, had she?

Some time later she said, "Well, at least they liked our little show."

Max untensed. "I hope I didn't embarrass you too badly. I just didn't know what else to do."

She nodded. "There's so much we don't know about the Segoori. It's hard to deal with them."

"I'd call it impossible." Max rubbed his neck. "You see why I wanted your help."

She nodded, but then a touch of anger darkened her eyes. "I can't say I cared for the way you said 'shut up,' though."

"Sorry. It wasn't intended as an insult. I was afraid the Segoori might see that we were improvising."

She snorted. "I've no doubt they knew that much from the start."

"Eh?"

"The Segoori are throwing us into bizarre situations to see how humans react," she explained. "Like we're rats in complex mazes. They want to see how clever we are."

Max was about to laugh in agreement when he realized she was serious.

Funny; he hadn't thought of that before.

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Then again, maybe it wasn't so funny. Man was no threat to the technologically superior Segoori. How better to learn an alien's psychology than to toss it into confusing scenarios and watch how it reacted?

Sharon was watching him with concern. "Max?"

He smiled to reassure her. "Your comment about rats in mazes really bugs me."

"Why?"

"I'm not sure who the Segoori guests were applauding. Was it Seven Tentacles With Spots, for creating the maze, or us, for figuring out how to get out of it?"

She smiled thoughtfully. "Both, probably."

"Yeah." He stared at the floor. He was supposed to be a diplomat; why hadn't he seen that? He focused a frightened glance at Sharon. "I don't like the way your theory affects my relationship with Seven Tentacles With Spots."

"All of a sudden he doesn't look so harmless."

"He never looked harmless, but at least he seemed to *like* me."

She laughed sharply. "Welcome to xenopsychology." Placing a reassuring hand on his shoulder, she added, "Don't feel bad. This is only your second encounter with the Segoori. You're doing quite well. Seven Tentacles With Spots wouldn't have invited you to his party if he *didn't* like you."

"Or think I'm an interesting specimen," Max grumbled.

She removed her hand and shrugged. "Does it matter?"

"It does to *me*."

"How unprofessional."

Max blinked. She was right. As a diplomat, his prime duty was to establish steady relations with the Segoori, not to seek their approval.

But then, did the rat-in-the-maze theory even apply? Or was it a paranoid notion that could poison his future dealings with the Segoori?

The stakes were much too high.

He was about to voice his thoughts when the shuttle signaled its arrival to their ship. Moments later the airlock chimed, and they exited into the corridor leading back to the living quarters.

"Would you like to get some coffee?" Sharon asked. "I can tell from the look on your face that you need to talk."

"Talk? Woman, you have me so confused I can hardly think!"

She chuckled. "Just doing my job, mister."

"How professional." But he smiled at her sideways. Glancing down at his tuxedo he said, "I'll take you up on the coffee, but we should probably change clothes first."

"Agreed." She nodded up the hallway. "I'm over in the next wing. Meet you here in ten minutes?"

Max agreed, returning the smile, and then went in his room. Once inside he shrugged off his jacket, loosened his tie—and gasped, noticing the message light on his computer.

Fearing the result, he punched the PLAY button.

Sharon's friendly expression fell as

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he stepped into the hall to meet her. "Max! Is something wrong?"

"Oh, nothing a small antimatter implosion wouldn't cure, at least temporarily."

"Hm?"

"Seven Tentacles With Spots called."

"Uh-oh. . . ."

"To thank us for making his party such a success."

Her shoulders, which had been tense, relaxed. "That's not so bad," she said cautiously.

". . . And to invite us both to his *niece's bris.*"

She frowned. "His niece? Is that possible? You mean, on them, the females have. . . ?"

He shrugged emphatically. "How would I know?"

"Are we expected to . . . participate?"

He shrugged again.

"Oh, God." She stared thoughtfully at the floor. "When?"

"Tomorrow morning. At 2:30 A.M. *Sharp*—so to speak."

She cringed, whether at the pun or the time he couldn't tell. "That isn't even four hours!"

"I know." Insanely, he found himself starting to laugh.

She grabbed his shirt sleeve and yanked him in the direction of the cafeteria. "Come on. We're going to *need* that coffee." Giggling, he let her drag him along. ■

EDITOR'S NOTE: Max Douglas and Seven Tentacles With Spots appeared earlier in "The Gift," in our January 1995 issue.

The art of progress is to preserve order amid change and to preserve change amid order.

—Alfred North Whitehead

Nature abhors smugness.

—Kelvin Throop

Let us live so that when we die even the undertaker will be sorry.

—George Bernard Shaw

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TUNNELING THROUGH THE LIGHTSPEED BARRIER

A controversy is presently raging in certain physics journals and conferences over whether Einstein's speed of light barrier has been breached by light itself. In particular, Professor Guenther Nimtz and his group at the University of Cologne in Germany have published results showing that they used microwaves to transmit what might be interpreted as a signal, Mozart's 40th Symphony, over a path length of 11.4 centimeters at 4.7 times the speed of light. In this column, I want to examine this faster-than-light (FTL) controversy and its implications.

One of the earliest triumphs of quantum mechanics, when the theory was first formulated in the 1920s, was George Gamow's use of quantum tunneling to explain the phenomenon of alpha decay. It was well known then that certain heavy radioactive nuclei, including the radium then widely used for glow-in-the-dark clock dials, would spontaneously and unpredictably spit out an energetic helium-4 nucleus (also called an alpha particle) and be transformed into a new lighter nucleus with two fewer nuclear charges. Alpha radioactivity is often very improbable, and this takes the form of alpha-decay half-lives measured in thousands or even millions of years. The question was, how and why did the alpha particle escape its prison in the nucleus, where it should have been tightly and permanently bound?

Gamow explained alpha decay as an example of quantum tunneling. He showed that while the particle can freely move with normal positive energy both within the nucleus and far away, there is an intermediate "forbidden zone" in which its net energy is negative.

Newtonian mechanics rigorously excludes particles of negative energy, so in that theory the alpha particle could never pass through the forbidden region. Quantum mechanics, however, is somewhat more permissive of negative energy particles. In the allowed regions of motion the alpha particle's quantum wave function is a complex sine-wave that characterizes its direction and momentum. In the forbidden zone the same wave function becomes a "dying" negative exponential, a rapidly decreasing function of penetration distance. This, Gamow explained, is how the alpha particle escapes its prison in the nu-

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cleus. It "leaks" through the forbidden zone as a dying exponential, emerging on the far side of the barrier with a surviving wave function that is tiny but non-zero. Gamow converted this small external wave function to an escape probability, and at a stroke explained how the alpha decay process is possible and why it is sometimes so improbable. Gamow's work has become a standard example of the application of the quantum formalism that is presented in most intermediate quantum mechanics textbooks.

One interesting question not addressed in Gamow's work, however, is how long the alpha particle, or its equivalent, spends in leaking through a barrier. This question was finally addressed in 1955 by Eugene Wigner and his student Leonard Eisenbud, who calculated the time required for the peak of the wave packet to pass through the barrier. Their conclusion was very strange. They found that under certain circumstances this transit time reaches a constant value that is independent of the width of the barrier. For a wide barrier and a constant time the corresponding transit velocity, i.e., distance divided by time, can easily become greater than the velocity of light.

Einstein's principle of causality, arising from the equivalence of inertial reference frames in relativity, states that in any reference frame an event occurring at some point in space-time can, at some point a distance L away, have no observable consequences earlier than a time L/c after the original event, where c is the velocity of light. The usual shorthand version of this, which begs the definition of a "signal," is to say that no signal can be transmitted faster than c. At the time of publication the apparent violation of Einsteinian causality implicit in the Eisenbud-Wigner calculation was ignored because it used the non-relativistic Schrödinger formalism. Later, however, Hartman derived the same result from a relativistic quantum formalism.

The paradox of FTL barrier transit velocity has not received much interest until recently, when it has been confronted by recent experimental work from two independent directions. Work in experimental laser optics performed at the University of California at Berkeley by Raymond Chiao and his group has used interferometry and "down-converting" crystals to perform photon-pair timing measurements at the level of about a femtosecond (10^{-15} sec). They have been able to clock the passage of single photons of visible light through an optical barrier made of multiple reflecting layers of transparent material acting as a destructive interference filter that selectively absorbs the photons of interest. Most of the photons striking the barrier are absorbed inside and do not emerge, but the few surviving photons traverse the barrier in a time of about 1.5 femtoseconds. The velocity derived from this measurement by dividing barrier thickness by transit time is 1.7 times the velocity of light.

However, Chiao and his group do not characterize their result as an FTL violation of Einsteinian causality. They point out that the operation of their

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interference filter requires multiple reflections at the many layer interfaces of their device, and a certain time is required for the destructive interference effect to build up. Thus, their barrier has a higher transmission for the part of the photon wave packet that arrives first, and much stronger suppression of the part of the wave packet that arrives later. This will cause the wave envelope to "advance" with the early part of the wave envelope dominating the transmission process. The photon thus appears to emerge earlier because of the time-variable transmission of the filter.

The experimental measurements of Nimtz and his co-workers at the University of Cologne operate in a very different domain. They use 8.7 GHz microwaves (free space wavelength 3.4 cm) traveling in a rectangular wave guide that contains a "barrier" section of reduced dimensions, in which the incoming microwaves become much weaker. Nimtz and his group have performed both time-domain and frequency-domain measurements demonstrating that their experimental configuration extends well into the region predicted by Eisenbud, Wigner, and Hartman where the barrier transit time becomes constant. As mentioned above, Aichmann and Nimtz have recently transmitted Mozart's 40th Symphony as frequency modulated microwaves through a barrier wave guide at an FTL group velocity of 4.7 c, receiving audibly recognizable music from the microwave photons that survived their barrier passage. The transit time through the barrier was about 81 picoseconds and was observed to be constant for barriers with widths varying from 4.0 cm to 11.4 cm.

The work of the Nimtz group raises the question of whether Einsteinian causality has in fact been violated and has spawned a controversy. The players in it, as is characteristic of cautious scientists, have engaged in a careful tableau of discussion of various definitions of "velocity" and "causality" that skirt any claim of the fall of Einsteinian causality. One contingent has suggested that the FTL speed in the Nimtz experiment, like that of the Chiao group, might result from time-varying transmission probability in the barrier waveguide. The other argues that the filter advance of the Chiao group is peculiar to their filter type and does not apply to the Nimtz results.

What is meant by a signal has also been a matter of debate. For example, Mozart's 40th Symphony, while it is certainly a signal in some sense, does not contain modulation envelopes or switching edges that rise in 80 picoseconds and could thus place Einsteinian causality under stress by conspicuously arriving too early. Further, since any increase in barrier thickness brings with it a corresponding and exponentially increasing attenuation of any signal, it is not feasible to increase the barrier thickness to distances large enough that the causal implications of the constant barrier transit time become more apparent.

It seems to me, however, that this is no longer a matter of theories or defi-

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nitions, but a question for experiment and/or simulation. The Nimtz apparatus should be viewed as one element of a longer multi-stage device that could reach the goal of directly testing Einsteinian causality. Such a device would be constructed of many stages providing 10 cm Nimtz barrier transmission elements alternating with short fast amplification and pulse restoration elements for transmitting phase modulated digital signals of high bandwidth. A digital signal, perhaps phase encoded, would be sent through a barrier element, received, cleaned up to restore its digital pulse structure and to remove the effects of attenuation and noise, then amplified and transmitted through the next barrier element. This should, in principle, be possible with no loss of information from stage to stage.

Provided each such element-pair contributes a net FTL group velocity, such pairs could be iterated to obtain very long transmission path lengths. It should thus be possible, given sufficient funds, to construct a device even kilometers long to provide a definitive test of Einsteinian causality and perhaps an unambiguous demonstration of FTL signal transmission. Or perhaps careful investigation will reveal some underlying problem, that makes this goal impossible. If so, I don't see it.

Since this is a science fiction magazine, let me now turn to the SF implications of FTL signal transmission. Through the works of Ursula K. Le Guin and Orson Scott Card, many readers of SF should be familiar with the concept of the "ansible," a device whose operating principle is never described but that provides instantaneous FTL communication between widely separated star systems and starships. It is a convenient device for connecting distant parts of an interstellar plot together without postulating FTL space travel. To a physicist, however, the ansible raises a plethora of questions. How does it work? How does it resolve the simultaneity ambiguities implicit in special relativity? If it does work, why isn't it used to find the glaring holes that must be present in relativity and to provide guidance to a better theory? Why don't they also use it to send signals backward in time? And so on.

A ground-based FTL signal transmitter using Nimtz barrier penetration would raise many of the same questions. Einsteinian causality arises from the democratic and even-handed way in which relativity treats all inertial reference frames. This democracy is feasible because no direct comparisons are possible of the times of events in widely separated space locations. With FTL communication such comparisons become possible, reference-frame democracy is destroyed, and a preferred reference frame for the Universe should become apparent. Special relativity would have to be modified to accommodate such results, becoming a new and different theory.

The other interesting SF implication of FTL communication is back-in-time communication. This is more difficult, but possible. You must have two FTL communication lines moving

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along carefully timed paths in opposite directions at near light speeds. In the ground-based rest frame, because of relativistic space-time transformations, the speed of the moving FTL line can cause the instant of reception of the FTL signal to occur *earlier* than its instant of transmission. To use this order reversal, the transmitted signals must be handed off from a ground-based transmitter to the input of FTL transmission system 1 moving to the right. The output of FTL transmission system 1 is handed off to the now-adjacent input of FTL transmission system 2, which is moving to the left. The output of FTL transmission system 2 is handed back to the ground station as it moves past it.

If this is done properly, the signal will arrive earlier than it leaves, and back-in-time signal transmission will have been achieved. I leave the reader to ponder the full implications of this, but clearly lotteries, race tracks and the stock market would be severely impacted. ■

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Grey Rollins

GARBAGE IN, GARBAGE OUT

When is a homicide not a homicide?

Illustration by Arthur George

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Late afternoon sunshine slanted over the dump as I carefully picked my way across the rotting residue of human society. Vast amounts of food lay around me, interspersed with crumpled aluminum pie pans and lids cut from tin cans; culinary roses nestled among metallic thorns.

I'd already eaten my fill, but I was trying to find the source of an elusive smell, one I didn't recognize. Since I consider myself an expert on the odor of refuse, this was an insult to my pride. Just as I was on the verge of giving up, I almost literally stumbled on the origin of the smell.

I wished I hadn't.

My six-inch legs don't cover ground very quickly, but it wasn't for lack of trying. My feet thudded against the packed dirt of the road leading between the mounds of trash, small spurts of red dust flying with every footfall.

"Martin!" I yelled as I ran. *"Martin!"*

No answer.

I sped on. As I passed through the gate, I caught sight of the car. And Martin. He was slumped in his seat, snoring. Asleep at the wheel—the story of Martin's life.

Breathing hard, I stumbled up to the car door and flailed at it with my hands. Martin's only response to my frantic assault was to snort once, then resume his deep, rhythmic imitation of a motorboat.

Desperate to get his attention, I unfurled two or three feet of my tongue, reached through the open window, and slapped him across the face several times in quick succession—the sound of a fresh steak hitting the counter at a butcher shop.

"Martin!"

"Wha—?" He jerked bolt upright, slamming his knees against the underside of the dash in the process. *"Ow!"* he howled. He saw me standing outside his window. "What the hell did you hit me with?" he demanded. Then realization dawned and he blanched.

"Victor! Do you mean to tell me you used your *tongue?* After you've been eating *garbage!"*

"Will you listen to me, you illegitimate offspring of baboons?"

He stopped in mid-yelp.

"There's a dead body out there, and all I could get out of you were sound effects for a monster movie! What did you expect me to do, sing you a lullaby?"

"Dead body? What do you mean, dead body?"

"One from which life has departed, you idiot! A stiff! A carcass! A corpus delectable!"

Martin's face twisted in horror. "Corpus *delectable?* You didn't! You wouldn't dare!"

"Martin," I said.

"I mean, it's bad enough—"

"Martin!"

"And if the relatives heard you talking about how their dearly beloved had *tasted*—"

"Martin!"

"What, dammit!"

"It's not a person."

"You wiped your slimy, nasty, greasy tongue on my face just to tell me there's a dead dog out there?"

"Martin, the corpse is . . . was an

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extraterrestrial. It was murdered."

Pete Sims is an old friend of Martin's who works for the police department—homicide, coincidentally, and in this case, providentially. Occasionally, he manages to throw us a case, usually when Martin's career as a private investigator is within mere hours of coming to an ignominious end in bankruptcy court. In short, he is a sterling friend who comes though in a pinch.

"Victor," he growled, running his hands through the unkempt remains of what had once been a full head of red hair, "this takes the cake, buddy."

We were standing near the remains of the alien body, where it lay half buried in wilted lettuce and crushed cardboard boxes for cheap stereo speakers. Overhead, the sky was darkening as evening crept stealthily from the east. Bats wheeled and dipped, harvesting the insects that fluttered around the faintly humming halogen lamps set on stands so that the police could do their work.

Pete spoke again, "I mean, it's bad enough that you've got to eat spoiled food. But really now, finding a dead body in the dump was the height of bad taste."

"Why does everybody assume that I gave this critter a taste test before going for help?" I protested.

Pete grinned maliciously. "It couldn't possibly be because you eat rotting garbage, could it?"

Like the corpse, I am an extraterrestrial, albeit of a different species. The climate of my home world is two or three notches above what humans call tropical. My species evolved as scavengers on the forest floor, eating the remains of both plant and animal matter even as it decayed. Humans prefer their food somewhat closer to its original, living state. Personally, I think they're daft.

Martin spoke up. "Pete, how much longer will it take them to examine the body? It's a nice balmy night and all that, but I can think of places I'd rather be."

Pete grimaced in response. "I know what you mean." He turned and called over his shoulder, "Pasky! What's the word, fella?"

Norm Pasky, a man with a jaw the size of the front fender on Martin's car, ambled over. "Not so good. The forensics guy says he's out of his depth. He says this critter was an Erintie, and that he doesn't know diddly squat about 'em. We're going to have to call in a specialist to determine time of death and all that."

"Simple homicide case, if it weren't for the fact that the victim was an extraterrestrial," Pete said.

"Looks that way," Pasky agreed.

Pete turned back to us and said, "Considering that we've got this complication with the victim being from off-world, I'll need a consultant or two. You guys need any money this week?"

"Nah, we're fine," Martin said breezily.

"Don't listen to him," I said. "The rent's late and the landlord is threatening to have the locks changed."

Pete tried to keep a straight face. "So, who do I believe?"

"Me," Martin and I said simultaneously.

Pete squatted and looked me in the

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eye. I only have one. "Supposing I were to ask you to help me with this little problem." He looked up, giving Martin the barest ghost of a cruel smile. "The pay would go to Victor, of course, since he's the expert on these matters."

Martin gulped. He knew he desperately needed the money, but his ego was at stake. He absolutely could not bring himself to admit that he was broke. Again.

I said, "I'll be glad to help in any way I can, Pete. Martin may be too busy with his other cases—"

I could almost hear the sound of Martin's pride being swallowed, all broken glass and rusty razor blades as it went down. "Pete, I, uh . . . considering the sensitive nature of this case . . . seeing as how it involves another species and all, I think I should volunteer also."

The plain, unvarnished truth? I didn't need the money, any more than a cat needs a bicycle, but it was fun to needle my best friend.

Besides, who else would drive me around?

The next morning Martin heard my feet padding across his bedroom floor and cranked open one eye. The effort clearly exhausted him.

"You getting up this morning?" I asked.

"No!" he said, pulling the covers over his head. The sheet puffed over his mouth as he spoke. "I don't *like* spending half the night at the dump. It smells bad and I don't like dead bodies."

"Corpses are an occupational hazard of being a private investigator. You could have been a stockbroker, you know."

"And wear a suit every day?" the sheet asked plaintively.

"You're planning on wearing that sheet to work, perhaps?"

"I'm catching my beauty rest," he said.

"You need it," I retorted.

The sheet came down and a baleful glare fixed on me.

"Listen, garbage breath, the early bird may catch the worm, but for all I care, he can have it. I don't intend to eat worms."

"They may be all you can afford. If your wallet gets any lighter, it'll waft away in the next strong breeze."

Martin cursed under his breath, then tossed the sheets aside and sat on the edge of the bed.

"The bathroom is that way," I said helpfully, pointing the way with a foot or two of tongue. "Brush your teeth before you talk to another human being—otherwise we'll have two corpses on our hands."

His eyes opened wide in horror. "*That* bad?"

"No, that *good*."

He shuddered. "Anything that smells good to you is certain to be bad news." He shuffled off, calling for his toothbrush as though it was a pet that would come when summoned.

Shorter than humans, taller than me, the Erintie resembled nothing so much as short-legged giraffes with a bifurcated, noseless head. One eye rose on either side of the elongated neck on a short stalk. Between the

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base of the eye stalks was the mouth opening with its short, almost flap-like tongue. The neck was boneless, supported entirely by musculature in the same manner as an elephant's trunk. The body was covered with what looked like dappled gray felt the color of a conservative business suit.

On the way out to the Erintie enclave, I had made Martin stop at a library so I could do some quick research. If Pete was hiring us as experts, it was the least we could do. I even went so far as to memorize a few phrases of pidgin Erintie.

I learned that, at least as far as humans were concerned, the Erintie were named after the man who first described them in the literature, Erin T. Booker. They were good-natured about the name and used it when talking to humans. On their home world, they lived on temperate savannahs, drinking nectar and rain water that collected in huge trumpet-shaped flowers on twisted vines the size of tree trunks. They were not above eating small animals, which they swallowed whole, lacking anything like teeth.

Representatives had willingly returned to Earth with the first explorers, partly out of a sense of adventure, and partly because humans and Erintie truly enjoyed each others' company.

After several wrong turns, Martin finally located the local Erintie colony. When we got out of the car, Martin and I were immediately aware of dozens of fluted voices, calling to one another across the meadow. Lovely sounds, like organ pipes. The Erintie tended towards monotonicity, forming words with their leathery lips and by varying the volume of their voices. Every Erintie neck was a different length, so each individual had a distinctive pitch. The resulting sounds did not fit the Western notion of a chromatic musical scale, but I would gladly have stayed and listened for ages.

My vocal apparatus, consisting of a membrane, was able to reproduce a fair approximation of the Erintie speech. I walked up to the nearest one and hooted a greeting.

The Erintie drew himself to his full height and stared down at me. After a lengthy pause he turned away, first ambling, then gaining speed until he was in a full gallop.

Martin glared at me angrily. "Now, look what you've done! If you've gotten us off on the wrong foot—"

"All I said was, 'Sweet fruit nectar to you.' It's a standard greeting. If you've got any better ideas, I'd be glad to hear them," I replied testily.

Martin stared at me, his thick, black eyebrows lowering over his eyes. "Sweet fruit nectar? What's that supposed to mean?"

"If you had read the entry in the encyclopedia, instead of trying to charm the librarian into going out with you, you'd know that wishing them sweet nectar is like wishing a human prosperity."

Martin harrumphed, continuing to glower at me. "Well, if you were so all-fired polite, why did he run off?"

I had to admit that I didn't know, which didn't help matters. We started walking slowly across the field, trying

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to make eye contact with another Erintie.

We had made it perhaps halfway across the meadow when we heard a melodious voice behind us. "Greetings. How may I be of service?"

I do not startle easily, but I literally jumped. Quickly, I turned, only to find an older Erintie a few feet behind us. He bobbed his head towards me.

"You are not human, but you were speaking English. I speak English. How may I be of service?"

I took a deep breath, still wondering how this old Erintie had managed to get so close without my being aware of his presence. "We were hoping to be of service to you. One of your kind was killed. We are assisting in the investigation."

"Let us begin with a name. Wheelau. That was the name of the individual of whom you speak. I am Hooth. You are?"

"I am Victor. This is Martin."

Again, his head bobbed. "You are official?"

"We are working with the police, yes."

"I see. What do you wish to know?"

"We wanted to know if you are aware of anyone, of any species, who might have wanted Wheelau dead."

His mouth open wide, Hooth took a deep draught of air that made a distant rattling noise down in the depths of his throat. "Those are harsh words, but . . . it was a harsh act. And you do not know our thoughts on these matters."

Obviously, I had run into an Erintie taboo. "I'm sorry if I said something offensive."

Slowly, the air came back out, almost like a sigh. "We must make allowances, you and I, for we come from different cultures."

Clearly, I was making a terrible mess of the whole thing. I was glad that Pete wasn't able to see his two "experts" at that moment. "How should I ask the questions I need to ask?"

Hooth bent his neck so as to focus his two eyes more closely on my one. "We will continue to use the English words. They are more blunt, more heartless, but the alternative would be to teach you our language and some of our philosophy. That would take too long. It took me years to master English. I am sure you found the same to be true, even with your more versatile vocal system. Suffice it to say that, like some humans, we find it . . . impolite to speak of those who have passed on in an untimely manner. In this case, however, I acknowledge the necessity."

"How would you handle this among your own people?" Martin asked.

"With great difficulty," Hooth acknowledged. "That is why I will use the English words. We will try. We will see what happens. It will be an experiment. Any anguish I bring upon myself by doing so will not reflect on you."

"What can you tell us?" I asked.

"Wheelau was universally well-regarded, both among our people and among humans. There is no individual, of either species, or of any other, who I think would want him . . . dead." His mouth crinkled. "There, I

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said the word again. Nothing ill happened. We will continue the experiment. Wheelau had many friends. In fact, he was so good at having friends that we made it his job, so to speak. He was a message carrier. One person would tell him something, then he would go and tell another. Doing so gave him a chance to see both individuals. He enjoyed this. So did those he spoke with. He carried news among the Erintie, among the humans, and between the Erintie and the humans. He never embellished, never forgot, never failed to deliver the messages. He will be missed."

Martin asked, "Why couldn't someone just tell the other person themselves? Why have Wheelau carry the message?"

"But the message wasn't from the first person, you see, it was *about* the first person, and Wheelau would make certain that all knew about the person."

"Knew what kind of things about them?"

"Good things, bad things, large things, small things. Life is full of news others want to know. It was Wheelau's function to tell them."

Martin frowned. "Sounds like gossip."

"Gossip!" Hooth exclaimed. "Exactly the word. Gossip. Small talk. Gossip. Wheelau carried gossip from person to person."

Martin's face twisted. "But people get mad if you gossip about them. Hell, there might be a thousand people who would want to kill Wheelau if they knew he was gossiping about them."

Hooth's eye stalks wavered agitatedly. "Gossip is what binds our community together! How do you do your job if not by gathering gossip? What are we doing now? I am telling you about Wheelau. I am gossiping about Wheelau. You will pick out the things you need and act on them to catch the individual who . . . killed Wheelau. How could it be otherwise?"

Reluctantly, Martin nodded. "OK, I see your point. Still, some humans won't like it."

"Hooth," I put in, "I see what you're saying, but Martin has a point, too. Some humans may not see the necessity of what Wheelau did. You said that Wheelau had some human friends. Could you give us their names?"

"He had one friend above all the rest. Boyce Coleman. You should talk to him. Boyce was nearly as good at gossip as Wheelau. He was the one who found out that his neighbor, Mrs. Airlie, was back from visiting with her daughter. We are," Hooth swung his neck in a circle as though to indicate the Erintie scattered around the meadow, "a gregarious species. We enjoy seeing humans interact with their families. It reinforces our sense of community with humans."

"Have you ever had any kind of trouble with humans before?"

"Well, there was an unfortunate incident three years ago, in which a car struck a young Erintie as he was playing in the road, but that was an accident, and the human driving the car felt truly bad about what had happened. The youngster lived, but is crippled. We take care of him. Other

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than that, no."

"It's just that people, humans that is, don't often react well to being talked about," Martin said. "I don't see how you've managed to avoid conflict."

"I understand your concern, but we simply provide much the same service as a newspaper in a small town. I fail to see how that could cause anyone to be upset."

Martin frowned. "It might depend on the information being passed. Let's say that Wheelau found out about something illegal going on and was telling people."

"But Wheelau had not gone to the police, or I would have known. You see, that, too, would have been news, and would have been passed around."

"What if Wheelau didn't realize that the information he had was so important. He might have thought that it was just a piece of ordinary news, when, in fact, it was very important to someone else. Lots of people have been killed for knowing too much."

"Perhaps it is not that humans have known too much, but that they have known too little. If everyone knew what everyone else was up to, then there would be less crime, would there not?"

There was nothing Martin could say to that.

Looking for Boyce Coleman's house, we came to Mrs. Airlie's first. Martin paused in the street. "Should we?"

"Wouldn't hurt."

Martin pulled his car over next to the white picket fence that surrounded her house. A limb from the large maple overhanging the gate caught Martin on the forehead, causing him to mutter a lengthy string of words that I'm certain he didn't learn from his mother. Sometimes being three feet tall has its advantages.

The woman who answered the door was on in years. "Ma'am, are you Mrs. Airlie?" I asked.

"Yes."

"Are you acquainted with Boyce Coleman?"

"Yes. He's my neighbor."

"My name is Victor, and this is Martin Crofts. We're assisting the police in an investigation into—"

"I know who you are, Victor. I read about you all the time. Is this about Wheelau?"

"Yes, ma'am."

She shook her head sadly. "I just don't know why anyone would want to kill Wheelau. He was better than most humans." She made a face. "I know that's not saying much these days, but he really was just wonderful. Did you know him?"

"No, ma'am. We've only met Hooth so far."

She nodded sagely. "Hooth's a good 'un, too, but I got along with Wheelau. Oh, and the way they sound! Reminds me of organs in church. I like to listen to their voices, even if I don't know what they're saying. I'd like to hear them sing, just once. I just know it would be heavenly."

"So you liked Wheelau?" Martin asked gently.

"*Liked* him?" She seemed truly surprised. "I fed him some of my jelly, and that's not something I do for just

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anyone, you know. That stuff's for my grandson. Got to use the right kind of apples . . . just one kind will do." Her eyes misted. "Wheelau said it tasted better than anything he'd had since he'd been here on Earth. 'Course, maybe he was just being polite. He was, you know. Polite, that is. Why, he'd come over here, and we'd just sit and talk. Sometimes Hooth would come with him. Sometimes Ianna or Benait. Usually just Wheelau. Lord, I'm going to miss him. It's not everybody that will take time to talk to a woman living alone. He was special, that one."

"Do you know anyone who might want to kill him?" Martin asked.

Her lips compressed, and she shook her head. "The world isn't what it used to be when it isn't safe for someone like Wheelau. No, I don't know why anyone would do a thing like that. I'll tell you how special he was. I've always wanted to ride a horse. Now, that's just not something I should be doing. A woman my age gets on a horse—no better balance than I've got—and falls . . . doctors wouldn't know how to begin to put me back together. I was telling Wheelau this last August, no . . . September . . . let's see, it was just after my good friend Jeannie got her new car. Anyway, the next thing I knew, he had me up and was riding me around the yard! Me! Riding an Erintie just like it was something that everyone did! Holding onto his neck for dear life, too. Oh, we had a grand time."

"What can you tell us about Boyce?" Martin asked.

"Well, I've known his mother since before he was born. His father's from down around the lower end of the county. Boyce and his wife moved up here after they got married about four or five years ago. They've been good neighbors, I guess. If it wasn't for them, I wouldn't have met Wheelau."

We chatted for a few more minutes, then went down the street to the Colemans's. Boyce opened the door when we rang. He was nearly as tall as Martin, but more heavily built; clearly a weight lifter. After we explained who we were, he invited us in.

"Man, I hope you guys find out who did it. Anybody who would hurt an Erintie is just plain sick. And Wheelau was the best of them all. You just tell me when you find out who did it." He made a wringing motion with his hands, shoulder muscles straining the fabric of his cotton T-shirt. "I'll take care of 'em."

"Do you know anyone who might have wanted to kill Wheelau?" Martin asked.

Boyce shook his head. "That's the part that doesn't make any sense. I've heard all that nonsense about gossip, but if you've met one, you know that the Erintie are more like a big, old-fashioned family that keeps up with their kin. They aren't just dabbling in peoples' lives because they're bored, they *care*. I'll tell you this—I like the Erintie better than I like people. They're decent, honest folk who'll do anything for you. Any one of them. These days, if you can name five humans who would drop everything and come running when you need them, you're a lucky man. *Every* Erintie is like that."

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Martin nodded. "That's what we keep hearing, but the fact is that someone killed Wheelau. *Somebody* didn't like him."

Boyce shook his head. "I honestly don't know."

Two blonde women came in from another room. Boyce glanced at them and smiled, then turned back to us. "This is Clarisse, my wife," he said, gesturing, "and Becky, a friend of ours."

They were both nearly as muscular as Boyce. "We're heading over to the gym," Clarisse said.

"Wanna come?" Becky asked, reaching out to touch his shoulder.

Boyce shook his head. "These guys are trying to help find out what happened to Wheelau. I'm going to talk to them for a bit."

"Well, if you get hungry, there's still some spaghetti left from last night," Clarisse said. She turned to us. "Good luck catching the bad guys. See ya."

"Bye," Becky added, as they went out the door.

"Where did you see Wheelau?" I asked. "Did he come over here, or did you go see him?"

"He came over here nearly every morning. We'd talk for a while before I went to work. Then I'd go see him in the afternoon, over there at the park." He grinned. "It's not really a park, I just call it that because they keep it so neat and clean over there."

"So you saw Wheelau often?" I asked.

Boyce nodded. "Oh, yeah. All the time. All of them, really. Hooth, Benait . . . whoever had time to chat, but Wheelau mostly."

"And you never heard of anyone who wanted to hurt any of them?"

The expression on his face seemed to indicate that he thought the question a waste of time. "Not once, not ever, no way, no how."

On the way home, Martin kept shaking his head. "Why would someone kill an Erintie everybody liked?" he kept asking, over and over. "Victor, this just doesn't make any sense. He had to know something. Just had to."

Finally, he did the thing I dreaded most—he started trying to use logic. It's not that logic doesn't work. The problem is with Martin's approach to logic. He begins with a perfectly reasonable scenario, then spins an ever more elaborate web until he has ensnared every living creature in the Universe as a possible suspect. Unfortunately, this means that he ends up looking for a needle in a haystack as he seeks out the actual perpetrator of the deed.

"There are three possibilities," he began. "The first is that Wheelau was murdered by a human. The second is that he was murdered by another Erintie. The third is that he was murdered by himself."

I gave him my best approximation of a skeptical look. "Run that last one past me again."

"Suicide, in other words."

"Ah! Much better."

"Now, if he killed himself, then we really only have only one suspect, namely Wheelau, himself. If he was murdered by another Erintie, then there are a fair number of Erintie on Earth, but it was most likely someone he knew, unless, of course, another

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Erintie came over here from another colony, which would add to the number of suspects. But then, you'd think someone would notice if a new Erintie showed up in town. Maybe we should ask the Erintie if they've had any visitors. On the other hand, if an Erintie was bent on doing Wheelau in, then he probably wouldn't advertise his presence in town, but someone else might have noticed. Do you think we should check the bus station? How *do* Erinties travel, anyway? Getting one seated on an airplane would be—"

Time to put a stop to this before he lost himself in recursive theories, like putting two mirrors face to face. "Martin—"

"Do you think if they went first class, that—"

"Martin!"

"Maybe they could push the seats back. Or maybe they could just slide in sideways, but then they'd take up two seats and that would be expensive." He frowned. "For that matter, where would an Erintie get the money for two seats? Surely, they don't—"

"Martin!"

He looked hurt. "Did you have to yell? I'm not hard of hearing, you know. All I was saying was that—"

"Listen, two eyes, I know what you were saying! You were on the verge of implicating the butcher, the baker, and the candlestick maker, plus sundry accomplices, pre and post facto. In another twenty minutes, you'd have hauled the entire living population of the Universe, their ancestors, and any potential progeny, up before the judge. I hate to be the one to break this to you, but there isn't a jail big enough to hold that many people."

"But—"

"Besides," I added "with everyone *in* the hoosegow, who would guard the joint?"

He, of course, had no answer for this, and subsided into uneasy grumbling for the rest of the ride home. Even with my acute hearing, I wasn't able to catch much, but I did get the impression that he thought I was ungrateful for his so-called help in trying to unravel the case.

Life with Martin is not always easy.

The next morning, I was spared the task of waking Martin. The telephone did the job for me.

I could hear Martin's sleepy voice answer. It did not remain sleepy for long.

"What?"

A pause.

"When?"

Another pause.

"Hooth?"

The handset slammed back into its cradle. Martin's feet shook the floor of the apartment as he came racing out of the bedroom. *"Victor!"* he shouted.

"I'm right here," I said quietly from a foot away. "What happened?"

"They scragged Hooth!"

"As in killed? Another corpus delectable? Hooth? But he was a nice—"

Martin's face screwed up, and he flapped his hands in my direction. "Yabba, yabba, yabba . . . for God's sake, don't start telling me what a great guy he was, or we'll never get anywhere." He scowled down at me.

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"Don't just stand there, Victor . . . make me some coffee . . . *do* something!"

"Coffee?"

"I need to be in top shape. My mind needs to be primed and ready to go." He paused, thinking. "Forget the coffee," he said decisively. "Let's go. I'll worry about coffee later." He started for the door.

I simulated the noise humans make when clearing their throats. "Um . . . Martin, don't you think you better put on some clothes before you go charging out into the world?"

He looked down at his naked body, then sheepishly back at me. "Right. Knights in shining armor are expected to wear shining armor."

As he padded barefooted back into his bedroom, I heard him muttering to himself about how nice Hooth had been.

"Throat slit, probably not long after dark," Pete was saying, shaking his head. We were standing under the trees at the Erintie colony.

"Nobody heard anything?" I asked.

He shook his head some more. "Not a thing."

"Nobody saw anything?" I asked.

Pete sighed. "As soon as the Sun goes down the Erintie go to sleep. It's a physiological necessity. They're helpless. They shut down completely. They're dead to the world."

"Pete!" Martin protested sharply.

He looked apologetic. "I guess that was a pretty poor choice of words."

"If they were *all* asleep, we can rule out any Erintie as a suspect," I observed.

"Oh, absolutely," Pete agreed.

"But with," I glanced around, estimating the number of Erintie, "say, sixty or seventy Erintie out here in the trees, how would the murderer know which one was which?"

"I had a bit of trouble asking that question. With Wheelau and Hooth gone, it turns out that none of the other Erintie know English very well. Eventually, Benait managed to get across that each Erintie stakes out a preferred spot. Rain or shine, they always sleep there."

"And with Hooth dead, it's beginning to look unlikely that Wheelau killed himself," I added, giving Martin a significant glance.

"Which leaves only the entire human race, plus thirty extraterrestrial races," Pete put in. He, too, is familiar with Martin's tendency to over-theorize.

"Well, no," I said. "Actually, it cuts the number of suspects rather sharply."

Pete has learned from experience that I can separate the wheat from the chaff more efficiently than many. "OK, Victor, spill it."

"Obviously, this was someone who was well acquainted with Hooth. They knew, at least roughly, where he slept. Granted, even if the Erintie are helpless once they go to sleep, it would take too long to search out Hooth by shining a flashlight in the face of every other Erintie out here. If he was killed not long after dark, then obviously the killer didn't take long to find Hooth."

"It could just be a coincidence," Martin pointed out. "They could have

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just happened on Hooth."

Pete shook his head. "Possible, but not probable. We're a fair distance from the road. If someone wanted to kill just any Erintie, they passed a bunch of them on the way here from the road."

"Hmmm. What if they came from back thataway?" Martin suggested, gesturing back into the woods behind us.

"Benait says that there are a goodly number of Erintie who sleep out that way, too. Hooth was surrounded by other Erintie on all sides."

Martin nodded. "OK. So it was someone who knew Hooth, and presumably Wheelau, too. I hate to say this, but what if it was Boyce Coleman?"

The look on Pete's face spoke volumes. "I'm coming around to that point of view."

I asked, "Has anyone told Boyce about Hooth yet?"

Pete shook his head.

"Martin and I just volunteered to do so. I want to watch his reaction when he hears about this."

The rising Sun was glaring down on the field as Martin and I trudged back to his car, leaving the police to see what they could glean from Hooth's corpse. The dew was evaporating off of the grass, hanging in the air like a veil.

It was strangely silent. Even the songbirds couldn't muster the energy to push a call through the heavy, humid air. Then again, maybe they, like everyone else, were mourning the passing of another nice guy.

* * *

It took a while to track down Boyce Coleman. His wife said he had left the house earlier than usual, citing errands to run. We could catch him at work around ten, she thought. He was the manager at the gym where he worked out.

Martin and I arrived just after they opened. Even at that hour, there were a surprising number of people straining at the weight machines. We found Boyce in a tiny office. A man his size made it seem positively claustrophobic, just by inhabiting it.

He received us cordially enough, then quieted when he read the serious expression on Martin's face. "Bad news, huh?"

"Boyce, someone killed Hooth last night," Martin said gravely.

Very slowly, almost gently, Boyce lowered his head into his hands. "Why is this happening? I saw Hooth just yesterday. He was. . . ." He sighed deeply, then raised his head. "Hooth was older than Wheelau. Less playful. He was sorta like somebody's favorite grandfather. Just a quiet, peaceful soul who couldn't do harm if he tried."

Martin cleared his throat. "Where were you around dark last night?"

Boyce's eyes flashed, then he grimaced. "Yeah, I guess that would be the logical thing, wouldn't it? I was over at the park talking to Hooth and Benait until it was time for them to go to sleep. Then I went home." He looked at Martin imploringly. "Does that help any?"

Martin shook his head. "Actually, it's about the worst possible thing you could have said. The only way you could have made it worse is if you had

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said that you walked Hooth to his sleeping spot."

Swallowing hard, Boyce said, "I did."

"So you knew where he slept?" I asked.

Boyce shrugged. "Sure. It's not like it's a secret or anything. Sometimes friends of mine go over there with me. I can think of probably a dozen people who've been there with me at one time or another. And I'm not the only human friend the Erintie have."

"Any of them show up over there consistently?" Martin asked.

"Not as often as I do, no." He looked up from where he sat. "What happened to Hooth?"

As Martin told him, I watched his face carefully. In the past, I've been able to observe minutiae in the behavior of humans that gave me hints as to guilt or innocence, but I learned nothing from Boyce's face.

On the way out, Martin looked across the room filled with grunting men fighting gravity to raise pieces of iron. Then he turned to me and said, "You know, Victor, it occurs to me that it would take a fair amount of physical strength to lift Wheelau's body and put it into a dumpster—"

"And Boyce has strength to spare," I finished grimly.

Meanwhile, Pete had managed to piece together the route of the garbage truck which had brought in the load containing Wheelau's body. By comparing the items of trash found in close proximity to the body, the police had been able to determine that the body had been in one of two dumpsters, both in the same city block.

"And I'll bet you can't guess where those dumpsters were located," Pete said.

"Near the gym where Boyce Coleman works?" I offered.

"Give the man a cigar, make that a moldy banana," Pete replied. "There's a large parking lot behind the gym with a dumpster on each side. Since the gym is roughly midway between them, sometimes they use one, sometimes they use the other."

Martin scowled. "Pete, this doesn't look good at all."

"Granted, it's all circumstantial evidence, but it is beginning to look pretty damning," Pete agreed.

"You going to bring Boyce in?" Martin asked.

Pete sighed. "I hate to base a case on such flimsy evidence, but it looks as though I'd better do something. The Erintie embassy has begun raising a fuss, and you know what that means."

"You need to produce results, pronto," Martin supplied.

He nodded. "Want to go with me to pick up Boyce?"

Twenty minutes later, we were told that Boyce had left work unexpectedly.

Pete managed to contain himself until he got back out to the patrol car. "That sonovabitch skipped out! I knew it, I knew it, I knew it!" he yelled, pounding on the steering wheel with his fist. "Why in hell didn't I nab that gorilla the very first time I laid eyes on him?"

I waited until he paused to take a

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breath before trying to insert a suggestion. "Pete, shouldn't we check his house? It could be simply that he wasn't feeling well."

He quieted immediately. "Leave it to an alien to teach me my job. Thanks, little buddy." He turned the key and started backing out of the parking slot.

"Can I make another suggestion?" I asked.

The car came to an abrupt halt. "Go for it."

"Wouldn't it be wiser to go to the Erinties's field? If Boyce *is* on the loose, he might try to kill another one. They trust him, and he could get right up to one of them before—"

Pete slapped his forehead. "Right again, Victor!" The car was in motion before I could brace myself. I fell sideways across the back seat, scrambling madly to grab something so as not to roll off into the floor. As we sped down the road, I heard Pete radio in for someone to check Boyce's house in case he was there.

When we arrived at the meadow, the three of us walked over to the nearest Erintie. With the pitifully few phrases I had at my command, I attempted to ask for Benait. The Erintie looked alert while I was speaking, then turned and galloped off.

While I had been speaking, the radio in Pete's cruiser had squawked. I turned and hurried back to the car to see what Pete had found out.

"It's Benait, Victor. Two boys were fishing under a bridge when his body came over the side. They heard a car speed off, but don't know anything more," Pete told me.

"Is he—" I started.

"He's dead. Shot, just like Wheelau."

I heard the drumming of an approaching Erintie and turned in time to see a young one come to a halt.

"Ianna," it announced.

I hadn't had time to completely figure out the differences between the Erintie sexes, but I judged this one to be female. Its coat was lighter and it seemed to be slimmer in the hindquarters.

"Do you speak English?" I asked.

"Slight, small amount," she said.

"There is a possibility that Boyce Coleman may have killed Wheelau and Hooth. If he comes here, we need you to tell us so we can deal with him."

"Boyce did not kill Wheelau. Boyce was Wheelau's friend. Boyce is my friend," she said, as though it was a law of nature.

"We hope that Boyce is your friend, but he may not be. He might try to hurt you."

"Boyce willn't hurt me."

Clearly, the Erintie were not lacking in loyalty.

Pete squatted down, so as to be on a level with Ianna. "Will you tell all the other Erintie to come tell us if they see Boyce? We need to talk to him."

"Talk to Boyce? Want to talk to Boyce? Boyce at work. He work . . . works until six, tick-tock time."

Pete patiently said, "We've been trying to find Boyce. He isn't at work. We just came from where he works. We thought he might be with you."

"Is Boyce hurt? Did they hurt Boyce?"

I was about to say no in an attempt

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to clear up the misunderstanding, but Pete was way ahead of me and saw a way to turn her confusion to our benefit. "He may be, Ianna. We want to see if Boyce's OK. If you see Boyce, will you come tell me? We're really worried about him."

Ianna was tossing her head in agitation. "Boyce hurt? Boyce may be hurt? You want me to tell you if he is hurt?"

"Ianna, I want you to come get me if you see Boyce, so that I can see if he's been hurt. And tell all the other Erintie the same thing."

"Tell other Erintie to tell you if Boyce is hurt," she said.

"Tell other Erintie to tell me if they *see* Boyce. I'll check to see if he's hurt," Pete corrected.

Ianna repeated this to make certain that she understood, then trotted off to spread the word.

We settled in around Pete's cruiser, awaiting news. It was not long in coming. The radio spat static. Pete grabbed the microphone. No one was home at the Coleman residence. Pete asked that the officer park a block away and keep the house under surveillance, perhaps from Mrs. Airlie's place, if she would agree.

There was nothing to do but wait. Hours passed. Curious Erintie ambled over and looked at the humans and the diminutive ET who wanted to see Boyce Coleman. With the exception of Ianna, none of them seemed to know any English, so there was little we could do.

At about six, still two or three hours until sunset, Pete started talking about a hamburger joint a few miles down the road. Martin responded by reminiscing about a steak house in the opposite direction. I gave them ten minutes to talk themselves into a state of uncontrolled salivation, then suggested, "Why don't you go somewhere cool, wring the sweat out of your shirts, and have something to eat."

"*Both* of us?" Martin asked.

All I could do was hope that the cerebral damage wasn't permanent. "Yes, both of you. It looks as though we're likely to be standing guard tonight and you might as well charge your batteries now, while it's still light."

It took another ten minutes to convince them that I could handle things, but they finally gave in. I watched them drive off, then set off on a tour of the area.

One could not have asked for a more bucolic scene than that presented by the Sun setting behind a meadow full of peaceful Erintie, quietly speaking in soft organ tones. The heat and humidity, oppressive by human standards, were a balm to my skin. Short of the Amazonian rain forest, a full-blown summer heat wave is the closest thing Earth has to the climate of my home world. In the dead of winter, my skin feels like ancient parchment. A good dose of summer swelter soothes and caresses my skin like Wanne's touch.

As I slowly walked the perimeter of the woods, I began daydreaming of Wanne, my para, left behind on my home world when I was kidnapped by Martin's uncle. Ah, the smooth skin of her knees, the tapering shape

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of her head. . . .

Ugh.

Clearly, I'd been on Earth too long. Calling the top portion of my, or Wanne's, body a head is a human habit. Something Martin had infected me with, no doubt.

I tried to sink back into thoughts of Wanne, but, once lost, the thread was not so easily picked up. By the time I completed my circuit of the meadow, I was in an advanced state of irritation. How dare Martin corrupt my thinking that way?

I milled around the region where Pete had parked, waiting for their return. As soon as they pulled up, I calmly walked over to the car, waited until Martin put his foot on the ground, then hauled off and kicked him as hard as I could.

No harm done, of course. The action was purely symbolic. I'm not strong enough to hurt him, and my foot is too soft to scratch or cut him.

He looked down at me, frowning. "What was *that* for? Did you get lonely or something?"

Pete looked over the top of the car. "Seems to me he was the one who wanted us to leave. If he got lonely, then it's his fault."

Martin gave me a wry grin. "What is it, Victor?"

"You've warped my thinking, you hairless orangutan."

"That's a tall order coming from a short order cook like you," he said, reaching out to pat me on my head . . . my *top*.

"My whole way of looking at the world has been warped, and it's your fault," I insisted. "Why, Wanne wouldn't even know me if she were to see me today."

He nodded wisely. "*Ahhh* . . . Wanne. I think I see the problem. You're suffering from a bout of homesickness."

"I am not so too, either!"

Laughing gently, Martin said, "Victor, if I could snap my fingers and let you see Wanne, I'd do it. I just don't know how."

That changed my perspective immediately. If I were to regain Wanne, I'd lose Martin in the process. A hard choice, indeed. Like the line from the old song, I'd grown accustomed to his face. To have Wanne *and* Martin would be the best of both worlds, both literally and figuratively.

As the Sun dropped lower in the sky, there was a noticeable tendency for the Erintie to cluster towards the edges of the clearing. They were still sounding musical notes to one another as they walked, but there was a quieter tone to the overall level of conversation. By the time the Sun slipped behind the hill, they were scattering into the woods, each to their private spot.

I spotted Ianna and made my way over to where she was standing. "Have you seen Boyce?"

"I have not seen Boyce. No one I have saided . . . talked to has seen Boyce. Boyce has not been here."

I thanked her and wished her a good night, then hesitantly reached out and touched her pelt. It was warm and soft to the touch. Like a horse, her skin twitched when I touched it.

"Tickles. Not bad tickle . . . good

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tickle." She rotated her head in nearly a complete circle, something I've seen owls do. "Looks like sleep. We will sleep now. You will wait for Boyce? You will not sleep?"

"My species never sleeps." How could I explain to a creature who had never been prey that it was the only effective way to stay alert for predators? I've never been able to understand how any creature on Earth sleeps. They are all prey to something.

"Tell Boyce hello," she said, then abruptly folded her legs and sat down. She was still awake, but said no more.

I wandered off in search of Martin. He had settled himself against the bole of a tree on the opposite side of the meadow. He had borrowed a flashlight and a gun from Pete.

Pete was pacing the ground midway between Martin's position and mine. He had just come back from his cruiser. "It's just going to be us three tonight."

"Were you expecting someone to help us?" I asked.

He nodded. "I was trying to get another warm body out here, but the consensus back at the cop shop seems to be that we can handle it. If something comes up, we're supposed to call in. What I can't get through their thick skulls is that if something comes up, we might be too *busy* for a nice, comfy chat. Not to mention that it'll take time to get somebody out here." He spat at the ground near his feet. "Idiots."

I left him fuming to himself and went back to my position. Night fell. Time passed. I got bored. There was no one to talk to, nothing to read. Zilch to do. The one and only thing I was supposed to do was stay alert. There was no danger that I'd fall asleep, but my attention kept wandering.

Subjectively, it seemed quite some time before I heard anything. Even with my acute night vision, I was unable to see anything at first. A vague flicker, nothing more. I turned to look more closely, then heard the thin sound of a tiny twig snapping.

A bulky body slid between two trees and made its way towards—

Ianna! I'd been a fool not to anticipate the identity of the next victim! One by one, Boyce had been picking off those he knew, beginning with those closest to him. How could I have been so *blind?*

I ran, stepping as lightly as I could.

But even at a stealthy walking pace, Boyce's longer legs were carrying him faster than I could go. He would reach her before I would. He was moving faster. I rushed forward, trading silence for more speed, trying to intercept him.

At the last instant, I realized that I had no plan for stopping him—a serious oversight that I solved by throwing myself in front of his feet, yelling at the top of my lung for Martin and Pete.

When his left foot hit my side, I had a brief glimpse of what a football must feel at kickoff. I felt my entire body flex, vainly trying to absorb the impact. Then I was lifted up, pushed by a size thirteen locomotive. I was still gaining altitude, surely traveling at escape velocity, when Boyce's body,

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coming down, collapsed across me.

If a mountain had fallen on me, it couldn't have hurt more. The only thing that saved me from certain death was that he fell across the lower half of my body, pinning me to the ground.

"Whuff!" Boyce grunted as he hit. Almost immediately, he braced his arms and did a pushup so violent that it threw him back into a crouching position. "You idiot!" he yelled. "Not me! *Her!"*

With that, he bounced to his feet and resumed running. I tried to call again for help, but discovered that inhaling cost more in pain than I could bear.

He made much more noise now as he ran, throwing caution to the wind. I watched as he ran towards Ianna, reaching out his arms to. . . .

Slam into another figure who had materialized out of the darkness next to Ianna. Again, Boyce crashed to the ground, grappling with a shadow. An arm went up, came down, and Boyce howled. Again, the arm went up, but Boyce caught it and slowly, struggling, forced it down to the ground.

A terrible scream of rage and frustration rose into the night just as Pete ran up, flashlight beam jerking as he ran. I could see the glint of blued steel in the light as he yelled, "Stop! Nobody move!"

And there, in the pool of light, I saw the last thing I'd expected to see. Boyce Coleman, sitting astride his wife, Clarisse, her arm pinned to the ground over her head, still straining to plunge the knife into her husband.

As soon as Pete yelled she went limp, sobbing. Boyce reached up and gently plucked the knife from her hand, reaching up to hand it, handle first, to Pete. Blood was streaming down from a gaping wound in his shoulder, dripping onto his wife's chest.

"Why, dammit? *Why?"* he demanded of her.

"I love you," she cried.

"*What?* You killed my best friend because you love me?"

Martin ran up, flashlight bouncing. "Boyce! Waitaminnit! *Clarisse?"* His head jerked from one to the other.

Boyce turned and sat heavily on the ground, leaning back against the still sleeping Ianna's flank. "Oh, man," he said, clutching his shoulder. "Oh man, oh man, oh man." He looked up at Pete and gestured with a bloody hand at Clarisse. "My wife. Oh, man."

"Martin," I gasped from where I lay. It was no more than a hoarse whisper, but it was enough.

His head snapped up. "Victor?" He jogged over and squatted next to me. "Anything broken?"

"Everything," I wheezed. "Pick me up."

Gently, he scooped me into his arms and carried me back. Every step he took jarred another bone loose from its moorings. If he were to carry me far, I felt that every joint in my body would separate. All I could do was buzz in time with his footfalls.

Martin, who knows that my muted *uhzzz* is equivalent to the human moan of agony, looked down at me. "You going to make it?"

"I think I just shuffled off this mortal coil. Mind the first step, it's a doozy."

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Boyce looked up at me and shook his head. "Just what are you made of, little fella? It felt like I hit a burlap sack full of rocks."

"Gravel, now," I assured him painfully. "Tiny, little, itty-bitty pieces of gravel. Next time I need to tackle you, I think I'll hire a stunt double."

"I know you suspected me, but it couldn't have been me. I love these guys too much," he said, running his clean hand across Ianna's side, still holding his shoulder with the other.

"And isn't that enough?" Clarisse shrieked suddenly. "That you love them? I could compete with another woman, but how was I supposed to compete with one of *them?* You're married to *me,* not some damned *alien!* Always running off to play with your little buddies, never time for me, never once—"

"Why didn't you say something, baby?" Boyce asked, his quiet tone a gentle counterpoint to her near hysteria. "I thought you liked Wheelau."

"*Liked* him? I despised him! I hate every one of these stupid, faceless horses!"

He gaped. "Why didn't you say something?" he asked again, but she had broken down into uncontrollable weeping and did not answer. He looked up at Pete imploringly, "What am I gonna do?"

"I think I'd start by having that arm stitched up," Pete responded pragmatically. He reached down and offered his hand to help Boyce to his feet. "Let's get you to a doctor."

Boyce, now standing, leaned over and smoothed Ianna's pelt where he'd been leaning against her. "I hope she's all right."

Which reminded me of something. "By the way, Boyce, Ianna told me to tell you hello when I saw you."

He smiled sadly at me. "She didn't believe it was me, did she?"

"No. She wouldn't even consider it."

"See? I told you these Erintie were better friends than humans."

Pete looked around at the half-seen shapes scattered in the darkness around us. "If wealth is measured in friendships, I'd say you're one of the richest men alive."

Boyce stared down at his wife. "Yeah? Then why do I feel so empty?"

A few days later, Pete stopped by the office. "Did you fellows get your rent paid on time?"

Martin nodded. "Yeah. Thanks."

Pete jerked his head at me. "Thank him. He's the one who yelled and got us over there. Boyce is a strong man, but Clarisse is a strong woman, and after she stuck that knife in his shoulder, it was bound to slow him down." He shrugged. "She just might have won the fight."

"I've been wondering how she knew where to find Hooth and Ianna," Martin said.

"Easy," I replied. "Remember, Boyce said that several of his friends had been over there with him. It's a cinch that his wife would have gone with him from time to time, especially once she decided to kill his Erintie friends."

"But she didn't kill Benait when he was asleep," Martin pointed out.

Pete said, "She picked up Benait,

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telling him that Boyce wanted to see him. Once she got him into the back seat of her car, she pulled out the gun and shot him. We found traces of his blood under the back seat. She pulled a similar stunt with Wheelau, actually taking him from the meadow to the gym, killing him in route. She figured that since the dumpsters were dumped automatically, no one would ever see the body. It would simply seem that he had disappeared."

"How's Boyce holding up?" Martin asked.

"He's pretty depressed. He lost everyone he cares most for, all in the same week."

"What was he doing out there, anyway?" I asked.

"Same thing we were," Pete answered. "Guarding the Erintie. He left work and went directly over there. He was up on the hillside above you, Victor, but not even the Erintie knew he was there. He was determined to be their guardian angel." He shook his head sadly. "It really took it out of him to find out it was Clarisse."

"Jealousy makes people do some weird things," Martin said.

"And xenophobia," Pete added.

"What's that?" Martin asked.

"Fear of aliens," I supplied.

Martin raised one eyebrow. "I may be a lot of things, some good, and some bad, but I'm not afraid of aliens." He grinned. "That's not to say I agree with what they eat, mind you."

"Hey!" I protested. "If I didn't eat at the dump, we might never have found Wheelau's body."

Pete see-sawed a hand. "A mixed blessing, fella. I still smell that place in my dreams."

"Kind of makes you hungry, doesn't it?" I teased.

Pete's face soured. "*Hungry?* Whew! Victor, the smell of that place just about curdled my innards."

Martin couldn't resist. He gave me a wicked grin. "Victor, you're always telling us how smart you are. You really blew it this time. If you'd fingered Clarisse earlier, it would have saved a lot of trouble."

I fell right into the trap. "But I didn't know—"

Martin eyed Pete, smirking. "Just goes to show you, garbage in, garbage out. . . ." ■

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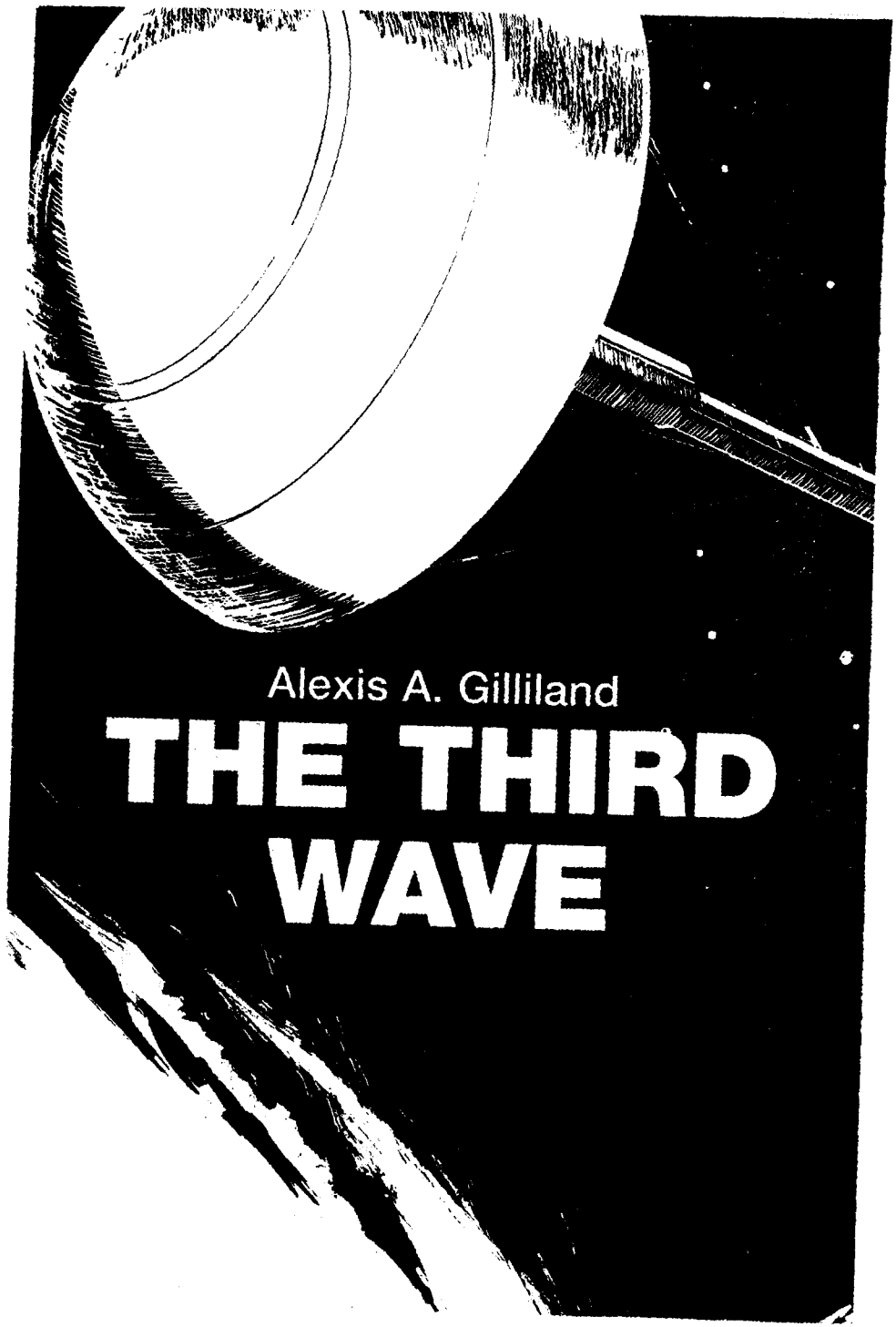

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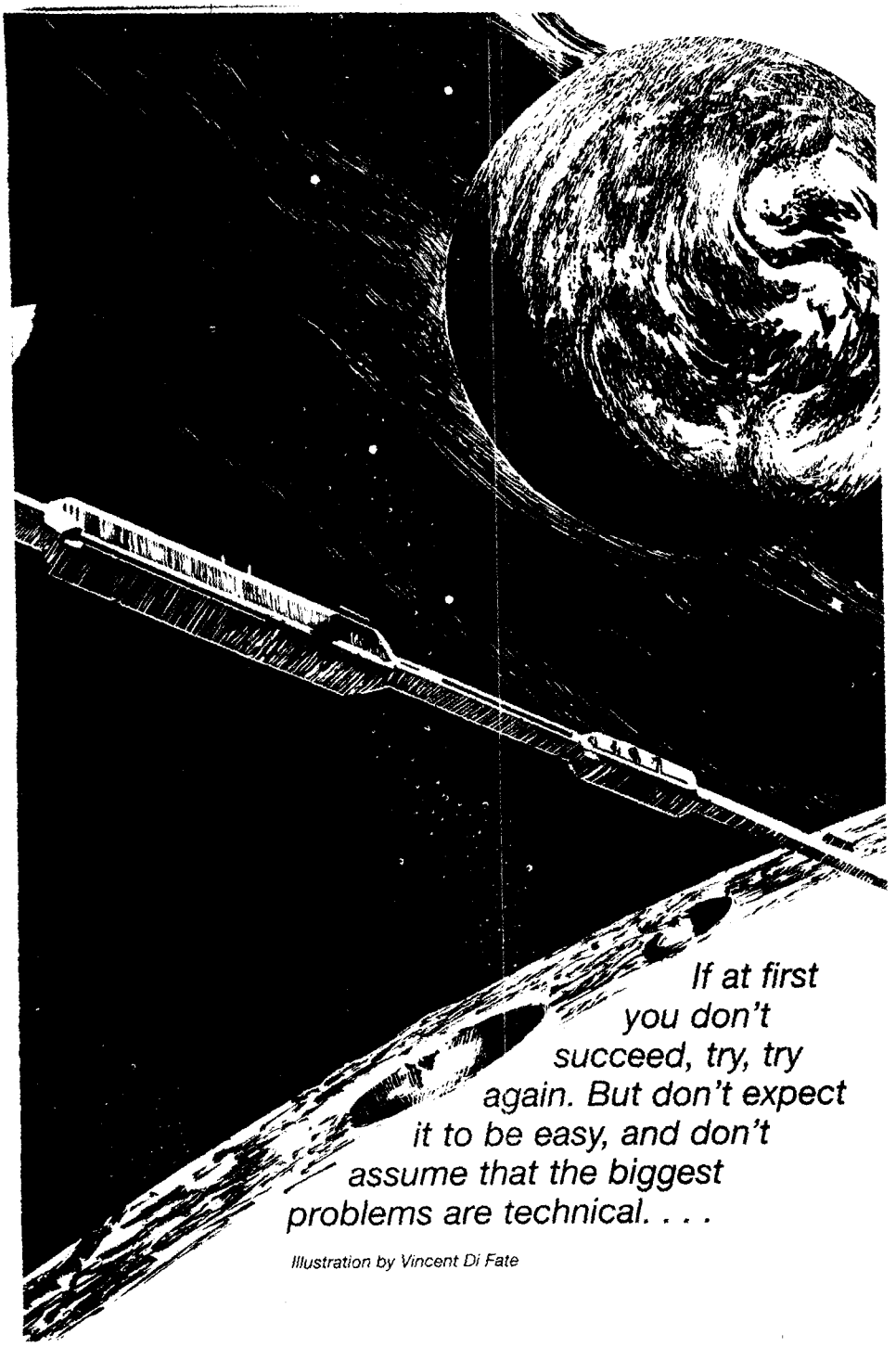

If at first you don't succeed, try, try again. But don't expect it to be easy, and don't assume that the biggest problems are technical. . . .

Illustration by Vincent Di Fate

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CHAPTER 1
First Comes The Seed

The intercom came to life. "Mister de la Haye to see you, sir," said the receptionist, as the secretary of the Navy walked in on the heels of the announcement with a young fellow in tow. Rear Admiral Fontaine, a tall lean man with dark circles under his eyes, stood up and came out from behind his desk to meet his boss half way.

"Always good to see you, chief," he said. "How did the hearings go this morning?"

The secretary of the Navy shrugged. From his demeanor, he was not a happy camper. "It's been one of *those* days, Henry. Ah went down to tell the committee that we need to deploy at least a squadron of nuclear warheads in lunar orbit to protect Earth from collision with comets and asteroids—or planetesimals as the staff wants to call 'em."

Nuclear warheads in lunar orbit? Fontaine winced. "Uh, I hope that was vehicles in orbit, warheads on Earth, chief?"

"Oh, hell yes, that's what I said to those people: We anticipate being in *full* compliance with the Geneva Convention, yes, indeed. For a supporting argument, I had some truly elegant graphics to show. Really neat stuff that actually went down 65,000,000 years ago, superimposed on today's landscape."

Fontaine nodded. His office had contracted out for them.

"Beautiful graphics, which ought to have been persuasive for the pitiful puny piddling program which those bean-counting scum-sucking liberal esso-bees have reduced us to, but no, the senator from Utah tells me that the latest survey of planetesimals crossing Earth's orbit shows positively no collisions for the next 250 years."

"Dilberg got the number wrong," Fontaine told him. "That's 2,500 years."

De la Haye eased himself into one of the chairs. "You're almost as much help as he was, Henry. So I says, yes, for the rocks, maybe, but what about the comets, what about *them?*"

"What about them comets, chief?"

"Dilberg's staff had dug up some neat graphics of their own, of course. You spot one of those suckers coming in, you send out a fleet of little robots with little dinky solar sails, maybe two or three acres each is all, and two or three of them latch on to the comet and reflect sunlight to *steer* the poor darling out of harm's way with jets of gas and whatever."

That would be the Japanese version of the Yelton plan, thought Fontaine. Technically elegant, but I don't think old Delay is in the mood to listen up on the subject. "The committee bought it?"

A slow nod. "We waltzed that one around a few times, but I could see those poor bastards going for the cheap. The Cis Lunar Missile Defense Protocol may not be totally down the tubes, but without nukes, no comet is going to take them seriously."

"Too bad," said Fontaine. Operation Clamdip had always been problematical, of course, but that was no skin off *his* nose. "What brings you here?"

"A helicopter," de la Haye said, his

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soft southern accent thickening, "Mah boss, the secretary of defense, arranged foah me to ride back with him out of the goodness of his heart. That good and kindly man is doing the secretary of state a favor by finding a slot for this young fellah, heah." He removed his glasses and wiped them with a handkerchief. "*And* he prevailed upon me by the force of sweet reason to see things his way. Admiral Fontaine, this is Doctor Turi John Ramos. Turi John, this is Rear Admiral Henry B. Fontaine." The two shook hands with pro forma expressions of pleasure. "Ah expect you can find him a place in your shop with no trouble at all, at all; y'all were looking to fill a vacancy, right?"

We had a vacancy, at any rate, thought Fontaine resignedly. Well, cooperate with the inevitable. "A mission-connected slot, sir," he replied, hoping to inspire feelings of guilt. "If I may ask, how come we're being gifted with such a handsome and talented young man?"

De la Haye shrugged. "When Ah asked mah boss why, all he tole me was that 'it was politically unseemly for a member of UNNDC to lobby for the repeal of the Geneva Convention.' Now lissen, Ah'm running late, but why don't the two of you set down and make yourselves acquainted? Ah'm sure things will work out jes' fine once the boy gets settled in." They shook hands all around, and the secretary of the Navy left. Fontaine resumed his place behind the desk, and motioned for Turi John to seat himself.

"You want to tell me about it, Doctor Ramos?"

Turi John Ramos, a thirty-something set piece out of *Gentleman's Quarterly*, crossed his legs and smiled politely, showing beautiful white caps on his teeth. "I'd be delighted, sir. How much detail do you want?"

"There was a time when I commanded a nuclear submarine and ate details for breakfast," the admiral shook his head. "But not now, not a half hour before lunch. Just give me an inkling so I have some idea of what ought to be done with you."

"Yes sir," replied Turi John. "My resumé, when it works its way up to your desk, will tell you that I took a bachelor and master of fine arts from the Chicago Art Institute, but I'm not an artist, and a couple of law degrees from the University of Chicago, but I'm not a lawyer, either. The senator found me a place with the Institute for Nuclear Disarmament, where I was an intern for a couple of years, and a fellow for a couple more. Then I went over to the UNNDC, the UN's Nuclear Disarmament Commission."

The admiral brushed one hand over his white hair. Focus on what is essential, he reminded himself. "The senator?"

"My mother's sister is married to Senator Metcalfe."

The good old boy from Texas that heads up the Appropriations Committee, thought Fontaine resignedly. Well, I'll be retiring in eleven months and nine days, and no way am I going to let this well-connected fop make me break a sweat. "So we may be doing the secretary of state a favor, mor than likely. How did you get in trou' over at the UN?"

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Turi John smiled and adjusted his Gucci silk cravat. "I wound up on the Plutonium Disposal Study Group. Nasty stuff, plutonium. Nobody wants it loose in the environment, and rightly so. Try to burn it up in power reactors, and it makes so much economic sense to breed more of the stuff that nobody is willing to even try it. When I was there, we couldn't even get studies funded. The best, the cleanest method was to put the world's inventory of plutonium in orbit and give it a few pushes so that it falls into the Sun."

"I remember," said the admiral. "Once the UN went public to get approval for the idea, old Jeremy Rifkin came tottering out of his nursing home to warn congress that the Sun might go nova, and the son of a bitch dropped dead in the middle of the damned hearing. After that, nobody could convince the American public to go with the idea, and if we wouldn't go with it, neither would anyone else."

"Exactly, sir. The whole issue is driven by irrational fear. On the other hand, with all the political instability around the world, it isn't safe to leave the stuff sitting around, and people know that too. The question is, can rational fear triumph over *irrational* fear?"

Do I hear a well rehearsed opening gambit? "Any fear can paralyze action," Fontaine replied mournfully. "If you ·ed people to move, sweet reason ·art them taking teeny tiny baby ·et reason will *not* persuade a great, dramatic leap."

· sit still on this issue," ·ng vexed as his argument slid away from where he had pointed it. "There are people coming to power who think you can use atomic weapons for political purposes."

Some people are fools, thought the admiral, but it can't be helped. "The rising generation seems to be a little more relaxed about nuclear weapons than we were," he conceded. "They maybe don't know as much about them, but they'll learn."

"Only a few charismatic and ignorant members of *any* generation want to use nukes, sir, but if the people are *also* ignorant, an, uh, excursion might happen inadvertently. Those hundreds of tons of plutonium in all the world's inventories are a sword of Damocles, hanging over all our heads." Turi John paused to pull his cuffs clear of his sleeve, displaying gold and jade cuff links in the process. "This is kind of a side issue, really. Nobody ever got in trouble for saying that nuclear weapons were too powerful to be practical."

"So what did get you in trouble?"

"It was a woman, sir. Madeline Tosca put me onto Freeman Dyson and Project Orion."

Fontaine's grey eyes blinked as his mind retrieved a long unused file. Ancient history from the dawn of the nuclear age, I do believe. "The nuclear powered spaceship?"

"Yes sir. Eventually, Dyson took the idea as far as it would go. He had a 100,000 ton spaceship using 300,000 hydrogen bombs, half to get up to 10,000 kilometers per second, 3 percent the speed of light; the other half to brake. The thing could go to Alpha

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Centauri in about 130 years, which is pretty neat, but the really important thing is that it would burn up all the plutonium in the world in a noble cause. So I looked up what I could, and did a little figuring, a little CAD—"

The admiral's eyebrows went up. "Where did you learn about computer assisted design, Doctor Ramos?"

"In art school, of course. Nobody paints with their hands anymore; it's all conceptualization and audacious visuals. The theory is to bypass the cerebral cortex entirely, exciting the brainstem—"

"Spare me your theories of aesthetics, Doctor. What got you in trouble?"

"Yes, of course, sir," replied Turi John, wrenching himself back onto the main track. "Now *that* particular concept, the one that got me into trouble, the secret meaning of the Orion Starship, is just so great, so aesthetically perfect, that I can hardly tell you! We take all the world's plutonium, that terrible stuff named after the lord of hell, and we use it to send man and life into heaven! Symbolically, it is the binding of Death into the service of Life, and the ultimate aspiration of our technological civilization and the salvation of mankind from the terrible demon technology has unleashed, and the visuals! Admiral, I did some really fine visuals."

The man is mad, utterly mad, thought Fontaine resignedly. He is, nevertheless, still connected. "For the Orion uh, starship?"

"Yes. The problem was, when I started talking up my ideas, showing my conceptualizations around, I ran bang-smack into the forces of reaction and ignorance." Turi John crossed his legs to display a multinational tasseled loafer: Spanish leather, crafted in England to Italian design by Indian workers. "The thing was, back in the dark ages, the US signed onto the Geneva Convention banning the use of nuclear weapons and nuclear-powered spaceships."

"Uh, banning the use of nuclear weapons in space, I think you mean. Go on."

"Whatever, sir. Well, the thing was, here was a really great way to get rid of this awful plutonium inventory we've accumulated, and the reactions of the people I talked to were really very, very positive about the idea. Then, just as I was about to go public, somebody lowered the boom."

"Probably the secretary of state," remarked Fontaine. "Being up to his ass in alligators, he didn't appreciate you telling him how to drain the damn swamp?"

"Oh no, sir. The secretary was very polite when I told him about what I was doing, but *somebody* in the State Department wanted me pulled off the team serving with the UNNDC. Professional jealousy, I do believe."

The secretary of state told you to back off and you didn't want to hear it, I expect. "Whatever, Doctor Ramos. Look, on a more practical level, you are entitled to your own office and your own secretary. The thing is, right now we don't have a private office to put you in, nor a spare secretary, either."

"That's all right, I don't mind a little inconvenience, as long as it's temporary."

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I'll be out of this place in less than a year, thought Fontaine. "Temporary is the word, young man. For the time being, we'll give you a desk in Captain Bauman's section."

"What sort of horsepower on the desk, sir?"

"All the perks you'd have in your own office, Doctor. Phone, fax, scanner, computer, and coffee maker. You'd like a window, too? We'll see what the captain has to offer."

"No copier?"

"Our copying center is just down the hall."

"Sounds good; what will I be doing?"

Ah, he had to ask. "That will be largely up to you. Your official title will be something like Space Program Conceptualizer, if that's any help."

"Uh, no sir. To tell you the truth, it sounds like drawing up pretty pictures to snow congress."

A flash of insight from this fop? People do surprise you now and then. "Well, not exactly. Captain Bauman will show you the ropes on this tight little ship of ours."

Captain Mary Ellen Bauman was a short, stocky brunette with a touch of silver in her close-cropped hair. She was tough as nails and looked it. "What do we do? Well, think about it, Doctor Ramos. What are the only products we can get from space? Information, which the intelligence community has been very, very tight about sharing, and power, beamed down as microwaves."

A regular Navy type, thought Turi John, uneasily. Terribly good at details, and no imagination, no soul at all. "On Luna they can mine iron with a magnet, I saw them doing it on television."

"Public television, I expect. Was that the program on building the centrifuge?"

"I think so," he said, crossing his legs. "Yes, yes, they were doing sand casting, in grooves pressed right onto the surface of the Moon, forming those huge cast iron girders to hold the 100-meter centrifuge together."

"Which is all very well for the poor bastards sweating out their tour of duty up there. It will make it a lot easier for them to return to Earth." Captain Bauman studied her new charge, looking for signs that he might be useful but finding nothing obvious or even hopeful. "But there is no way in hell that we are going to be able to deliver a few thousand tons of steel to Detroit or Yokohama. Which leaves beaming down microwaves."

"But you could deliver thousands of tons of steel into lunar orbit, couldn't you?"

A sigh. "In principal, yes, Doctor Ramos. There is, alas, no demand for steel in lunar orbit."

"Not even for building power plants so as to beam power down to Yokohama and places like that?"

She shook her head. "Unfortunately, the answer is no. We've done a feasibility study, constructing the tiny pilot plant that's beaming power down to Luna Station, but that was all she wrote."

"Why aren't you going forward?" asked Turi John.

"Politics. Power is in surplus right now, what with all the wind farms and

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pv panels coming on line, with I don't know *how* many cogeneration plants upping the efficiency of our existing facilities. The vested interests don't want to disrupt the status quo, and *nobody* wants to spend billions and billions now to save a penny or two per kilowatt-hour later."

Wasn't there something he'd read, somewhere? "Couldn't you dedicate that extra power for making fresh water from the sea?"

"What, you watch PBS on a regular basis? I vetted the script for that program, and saw to it that they didn't make the case against the idea."

He looked a little shocked at learning that PBS might have had a slant in its reporting. "Which was?"

"Enemy action," she said. "What they left out was that those space arrays beaming down the power are big, fragile targets, vulnerable as hell."

"Up there in space? How could they be vulnerable?"

"Lasers, missiles, sabotage, you name it. No nation is going to put itself in a position where its enemies can cut off its water. Look what happened to Syria and Iraq after Turkey built those dams to cut off *their* water."

"That's how the Neo-Turkish Empire came into being," conceded Turi John. "Maybe in California?"

"We-ell, being the inde-goddamned-pendent Westerners that they are, Californians supported the idea, as long as they weren't going to have to pay for it. The rest of the country is tired of developing the West, and the bill never got out of committee."

"We aren't doing *anything* in this office then?"

"Right now, Doctor Ramos, things are pretty much at a standstill. What can be done technically is either utterly forbidden or totally unfunded."

"These pictures are very nice," Admiral Fontaine said, admiring the portfolio Dr. Ramos had brought in. "They look rather like Chesley Bonestell's work."

"People have told me that," Turi John said. Then he laughed. "The computer software I used does all the hard stuff. Me, I wouldn't have the patience to fiddle with shadows and angles and all the little detail sh—" he caught himself "—tuff."

Captain Bauman's eyebrows went up. "Shtuff? Right. Now what was it you were saying we should be doing with this cockamamie thing?"

"It's a way to get rid of the world's plutonium stockpiles," he replied. "An end result devoutly to be desired."

"Look, Doctor Ramos," growled the white-haired man. "Finding a sink for plutonium isn't our business."

"It has a lot of popular support, sir."

"Not in the Defense Department. You must know that the joint chiefs are very skeptical about giving up anything they can't get back."

"They gave up nuclear missiles," replied Turi John.

"But not the plutonium. Push comes to shove, the inventory can be remade into warheads."

Which is why everybody wants to get rid of the awful stuff, thought Turi John sadly. "Are they going to do it before you retire?"

The admiral smoothed back his

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white hair. "Not bloody likely," he conceded at last.

"So this will put some life into our moribund space program. All we really need is to get our project excused from the Geneva Convention. Once that happens, there will be such a gush of funding that we won't be able to spend it all."

Captain Bauman looked bemused. "Now, now, Doctor Ramos. Doubling the US Squadron of the High Skies Fleet would soak up more cash than will ever be forthcoming."

"High Skies Fleet?"

"A little Navy humor, there. The several models of the Delta Clipper that replaced the shuttle are a so-called fleet under the nominal command of the UN, the various squadrons being under the command of the nations that paid for the individual ships, the US, Russia, Japan, Germany, a joint Franco-British squadron, and China."

"Well," said Turi John, doubtfully. "I'm sure the joint chiefs will get all those Delta Clippers under a unified command at the appropriate time. What we do first, see, is design an Orion Starship."

"Like your drawings?" she asked delicately.

I know my limitations, you bitch. No need to rub my nose in it. "*My* drawings? No, no, do it right, put your back into it, use classified research, that sort of thing."

"Hmm," said Fontaine, his grey eyes thoughtful. "Do you know how much stuff we don't know how to build? You're talking a hundred-year trip here."

"So we start off small," said Captain Bauman. "A research ship to find out what we need to know."

"The joint chiefs won't like it," said the admiral.

"You? You're retiring in less than a year," she said. "What do you care if the joint chiefs don't like the idea? We don't have to ***build*** anything, you know."

"Not build anything?" Turi John was distressed. "What do you mean?! Building the Orion Starship is the whole idea!"

"No," said Captain Bauman pensively. "If the admiral agrees, I'll turn in a six-iteration preliminary design . . . which, off the top of my head, will weigh in at 100,000 tons, just like Freeman Dyson suggested. Then Doctor Ramos here will run it up the flagpole and see if anyone salutes."

"Wait a minute," said Turi John, suddenly apprehensive. "What is it I'm going to be doing?"

"You, Doctor Ramos, are a political appointee," she replied. "What you do is pretty much inde-goddamned-pendent of what I, or the admiral or the joint chiefs or the secretary want. Right?"

You bitch, you're going to get rid of me, aren't you? "Uh, yeah. Yes, I guess so."

"So what we do here in this office, really, is design stuff that never gets built. For you, we'll design an Orion Starship prototype, with the clear understanding that it is a prototype, that it's going to need work. You, in turn, will hold an unauthorized press conference, in which you announce that you have found a sink for the world's plutonium."

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"But, but . . ." My God, thought Turi John, dismayed, even the senator couldn't get me out of the mess that will stir up. ". . . that could cost me my job."

"Well, yes, Doctor Ramos," said the admiral in his kindliest manner. "That *is* the down side of the idea. You've been telling us how wonderful this Orion Starship is, so surely you ought to be willing to take a few chances for your brainchild."

"You want me to get my people started on the thing?" asked Bauman.

The grey eyes were hooded in thought. "Explain the circumstances to them," said Fontaine at last. "It might be good for morale."

Dr. Sioux Kerry finished the adjustment and came off the top of the four-meter ladder with an easy drop against the gentle lunar gravity. "Now try it," she said. Winslow hit the switch, and the huge optical cable, thicker than a man's arm, pulled back from the light pipe it was insolating, and rolled on the semi-circular track, throwing a powerful beam of sunlight across the inside of the vaulted room as it did so. Finally it aligned itself with the second light pipe which insolated a second growing chamber, pushed itself forward into position, and locked itself in place with a gentle click. The first chamber was now dark, the second brightly lit.

"Works fine," said Winslow, approvingly. "Break for lunch?"

Kerry nodded, and folded up her utility tool. "Prototypes. If I was doing it over again, I think I'd lose the damn track, though."

"You need to have the on-off cycle so the plants will grow don't you?" During the two-week lunar night, the alternation was done with electric lights, which presented no switching problems. During the two-week lunar day, the two chambers alternated day and night by piping in raw sunlight, and the switching was easy once you figured out what needed to be done.

"Yeah, sure. Only the way we built it, there's too much play, too much gross motion. You see how that cable keeps getting out of adjustment, don't you? This is the third adjustment in two months. What I'd do is have the optical cable coming in from the parabolic mirror, I'd have that cable stop up *there* on the ceiling. Then we'd put a secondary optical cable on each light guide, and make the switch between the two chambers by going. . . ." She made a hand gesture to indicate turning a switch and snapped the utility tool into its pouch.

"That would work. Maybe that's the way we ought to do it on the next one," suggested Winslow.

"What next one?"

"Complex Six, Doctor Sioux. We finished the excavation already, and so far the chambers are testing real good as far as leaks are concerned. The power lines are in place, so all we have to do is install the lighting system and start growing stuff."

A sigh. "We haven't got enough water. We don't even have enough water for here."

"We don't need water, do we? Everything gets recycled, right?"

"Eventually." Kerry opened her lunch box. "Look, Winslow, one of the

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things we're wanting to do eventually is set us up an orchard. Fruit trees, all right? Apples, oranges, peaches, plums, you name it. Know what the problem is? Our water inventory gets tied up in the wood and isn't available for recycling."

Winslow blinked. "Trees aren't water," he said. "Trees are wood."

"Come on, Winslow, wood is mostly cellulose, which is a sugar polymer, and sugar monomer is typically $C_6H_{12}O_6$, one molecule of water for every atom of carbon. Cellulose is more than half water, for God's sake."

"Well, we just have to requisition some more water then."

Kerry unscrewed the thermos and poured herself a cup of hot tea. "At $200 a pint for shipping you aren't going to get much."

"It's a lot cheaper growing our own food up here than shipping stuff up from Earth."

"That's true." She took a cautious sip of tea. "What's really cheaper, though, is to cut staff. That way, you don't need to schlep up the food *or* the water."

Winslow unwrapped an egg salad sandwich. The local food chain recycled human wastes to bacteria, feeding the resulting single-cell protein to the chickens. "You hear rumors," he conceded. "But they aren't going to close us down. Are they?"

"Remember the prospectus? The big deal was: We'll beam cheap power down to Earth and build a city in the sky doing it. You know what happened? Wind farms happened. New and improved photovoltaics happened. Power got cheap. How cheap? Cheaper than we can make it. We're here because we're here, but as God is my witness, we sure aren't going anywhere."

"How come?" he asked. "I mean, all that we have to do is start building the stuff, power stations or DSMs, whatever. We can do it here, or in lunar orbit, whichever works best."

"You think cities are all glass and steel, don't you? Back home, cities were always built where the water was, and what the earliest civilizations were all about was hydraulics; dams, levees, canals, irrigation projects." She took a bite of her chicken sandwich, and washed it down with a swallow of tea. "Water is something Luna ain't got, Winslow, and without water, there aren't going to be any cities."

"Not on Luna, maybe, but in orbit, at the L-5 point or somewhere."

She sighed. Winslow wouldn't admit that a lack of water was more than a temporary problem, soluble by signing a requisition form. "Yeah, sure. Look, what a city needs is a hinterland, someplace to grow the food, right?"

"That's what we're doing here," he agreed. "Edibles engineering."

"You don't like farming? The other thing a hinterland does is recycle, reusing the—call it the post-consumer edibles."

"Well, we recycle now, Doctor Sioux."

She finished her sandwich. "Yeah, sure. And I can taste the single-cell protein they fed that poor chicken, too. It would be nice to eat a little higher on the food chain, Winslow, but for that you need water."

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"I agree! What do you say we requisition a couple of tons?"

"Hey, as long as you're wishing, why not a couple of *hundred* tons?"

CHAPTER 2
The Planting

The gods blessed Turi John Ramos's press conference with a slow news day coming at the end of a slow news week. He looked out at the reporters who had responded to his early morning call and knew that he was going to get his hearing. They'll hear what you have to say, he thought, and refuse to believe it, to act on it, so at the very best you'll be going down in a blaze of glory. He found the thought terrifying, but at the same time oddly comforting; if the world couldn't be saved it wouldn't be because he, personally, hadn't done his best.

Palms moist, mouth dry, he walked up to the podium as punctually as if he was attending his own execution, and began his presentation. He rambled on for twenty minutes explaining the evils of plutonium, the rationale for building the starship, and another ten on the necessity for getting an exemption from the Geneva Convention. Then, as his allotted time in the departmental auditorium was beginning to run out, he came around to the business at hand, the solution he was proposing to the problems he had just outlined.

"The solution, ladies and gentlemen, is to build an Orion Starship, a starship driven by hydrogen bombs." There was a sudden stir as the reporters pricked up their ears; there was a story here, after all.

"There is, of course, far too much that we don't know about building an Orion Starship, let alone building one in space, which is where it would have to be done. So what we are proposing to do is take it in small steps. First, set up a yard, or an assembly area in lunar orbit, where we can collect matter shot up from the lunar surface to build ourselves a prototype. It is our belief that the physics of the Orion Starship can be solved rather easily. The initial plans call for a vehicle massing 100,000 tons, driven by a parabolic sail 1,200 meters deep, having a mouth 2,000 meters wide. At the focal point of the parabola, we will explode—in the vacuum of space—a hydrogen bomb, which will give our vessel a kick in the pants—pardon me, an impetus—amounting to a one second pulse of about six *g*. Two times an hour for eight and a half years." He turned to the model he had brought with him, a clear plastic hemisphere with a long, skinny stem. "That's hard traveling, folks. The recoil mechanism will soften it, sort of like this. . . ." He held the stem and pushed the bell up onto it, hoping the drop of oil had stopped the sticking, and smiled with relief as the bell slowly returned to its original position. "We think a thirty or maybe thirty-five minute interval is necessary—one of the things we're looking to find out for sure—to let the sail cool sufficiently to prevent any heat buildup from the repeated explosions that will drive the ship. At that rate, we sustain an average acceleration of about 0.02 *g*.

"To learn what we need to know, the prototype needs to stretch its legs,

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so we will not go to Mars, as has been suggested, but beyond Mars, to the outer asteroid belt. The specific destination our staff has selected is one of the Trojans, Diomedes, diameter 171 kilometers, which is known to have frozen water. At 0.02 *g*, this trip of 5 astronomical units, a nominal half billion miles, will take about 34 days, burning up 1,600 hydrogen bombs in the process. I have heard it said that all the Moon needs is a little water and a better class of people to be a pretty decent place. Well, ladies and gentlemen, that's all *Texas* needs." There was a laugh. "We plan to have a better class of people on board, and we know that Diomedes has water. It will have to be mined, but once at its destination, that ship of ours can easily take on all the tons of water and soil they want, and spin itself to provide our heroic crew the gravity they need." He looked around. "Any questions?"

"Will the ship be making a round trip?" asked a woman in a red dress.

"No," replied Turi John. "Once we reach Diomedes, the crew will practice setting up a working habitat, just as we would expect them to be doing at the end of their generations-long trip."

"How are they going to get back?"

"The ship's boat will be provided with mass drivers mounting microwave antennae that can be remotely . . ." Turi John stumbled, and consulted his teleprompter. "Sorry. That would be coherent beams of microwaves from the ship's power plant that would be remotely controlled to track the mass drivers. What sort of power plant, here? Solar power, the most environmentally friendly kind. That great sail will focus the raw sunlight falling on an area of 3.14 million square meters to provide our crew with the power they need to thrive and survive, and eventually, to come back to Earth. The trip home will take longer, but it is, in principle, entirely safe."

He looked around the auditorium, amazed to find the reporters were hanging on his every word, dismayed to see the attendees of the next function filtering in. "With this project we will, of course, greatly improve our understanding of the material science and the physics of the starship we seek to build. More important, the crew on the prototype will learn invaluable lessons about living in space. Once they are orbiting Diomedes, our crew, drawn from the nations that will be contributing plutonium rocket fuel, will have completed that first mission. As they dig into the surface of Diomedes to mine water and soil for agriculture, they will be learning what the crew of Starship Orion will need to know to survive around Alpha Centauri." That wraps it up, thought Turi John. Now what was my finish? His eye caught the teleprompter. Oh yes. "There are those who say that the people of Earth will get no material benefit from this. I say that if the Starship Orion does not return so much as a single out-of-focus picture it will have still been of inestimable benefit to humanity for what it has taken from them." He looked over his audience to see a naval officer making the finger-across-the-throat sign. "The sailors at the rear of the room have

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some fact sheets for those who are interested."

The secretary of the Navy, a good old boy from South Carolina who wore a hairpiece colored a decade or two younger than his hair, sat in his tall leather chair behind his huge mahogany desk and glared at Fontaine. "What the hay-ull is the idea of this, admiral?"

We aren't on a first name basis anymore? What a pity. "Look, Delay, you were the one who said I had to take on this Ramos fellow. *You* talk to him, why don't you?"

"I don't need to talk to Doctor Ramos, Harry, his undated letter of resignation has been in the secretary's safe since the little greaser came on board." Fitzgerald de la Haye's soft accent thickened with anger. "Ah need to talk to *yew!*"

He wants me to humbly beg his pardon, thought Fontaine. Well, the little son of a bitch can kiss my ass. "So?"

"You ain't making this any easier on yourself, boy. Did you authorize that damned press conference this morning?"

"Verbally. Doctor Ramos was supposed to submit to me the text for vetting, but he never got around to it."

"Oh. He never got around to it, did he, Harry? And you just let him have that press conference of his without any idea of what the man was going to say?"

Fontaine smoothed back his white hair. "That looks to be what happened, Delay."

"Did you, Ah say, did yew have any idea what the man was going to say?"

Tell the truth and shame the devil? "Of *course* I did, you damn fool. Turi John Ramos ran his mouth flat out the whole time he was in my shop."

"Ah, shee-it. Admiral, it was your bounden duty to keep that boy's trap shut, his nose clean, his ass out of trouble. That speech he gave was on all the TV shows, and it makes us look like a pack of idiots here at Deefense. . . ." Secretary de la Haye sat back in his chair, scowling. "Harry, I'm sorry, but you got to take the fall for this."

My computer is already cleaned out, and my hardcopy files as well, thought Fontaine coolly. I can walk out of here any time I damn please. "If you say so, Delay. I'll put in my leave slip right away."

"Leave slip? I want your resignation, boy!"

The pouchy grey eyes looked amused. "Oh, really? I have enough leave to cover me over my retirement date, Delay. That's as close to resignation as you're going to get." He reached into his pocket. "Indefinite sick leave. You'll need to authorize it, of course."

"Whut the hay-ull? What is this, Harry?"

"A leave slip. Don't you political types believe in paperwork?"

The secretary of the Navy crumpled the slip into a ball of paper and threw it at the waste basket. "You're not getting out of here *that* easily, boy. There's flak to catch, and *yew* are going to be up in front to catch it! Once you get sick of it, you miserable

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bastard, once you got yourself bloody well fed up, *then* you can resign!"

"This trial balloon of yours was a stupid, pernicious idea," said the secretary of defense. "Nevertheless, some people who ought to know better are clapping like trained seals at this display of unexpected brilliance from *your* Navy Department, Mister de la Haye."

The secretary of the Navy blotted his forehead with his handkerchief. "I'll issue a statement killing it immediately, sir. Or I'll have Rear Admiral Fontaine repudiate his work for us. No problem."

"Getting the genie back in the bottle may be harder than you think. The Russians, of all people, have said that this seems to be an excellent solution for the disposal of their inventory of pits—those grapefruit-sized balls of plutonium left over from the Cold War." He paused. "They *are* a bit of a security problem, of course."

"And the French," added the secretary of state. "The French support the Russians, claiming they would welcome this opportunity to dedicate their own stockpile of fissionables to what they describe as 'this humane and civilized use.' "

"Well, uh, I'm sorry that the idea is making waves," said de la Haye. "But it isn't a program, or anything. It's just an idea—isn't it?"

The secretary of state doodled on the yellow pad before him. "Well, my information is that the Russians are going to present it as a formal proposal in the UNNDC."

"That's blue smoke and mirrors. My Gawd, where did you git holt of a tale like that?"

"The Russian ambassador asked me. Since it was an American—he called it an initiative rather than a trial balloon—if we were going to move on it immediately, Mister de la Haye. When I said we were presently taking the matter under advisement, he asked if we would mind if *his* country formally introduced *our* proposal."

De la Haye's mouth fell open. "What did you say?"

A shrug. "I told him we'd get back to him. He said he hoped it would be within the next day or two, because our 'initiative' is very popular. The Russian Parliament has already passed a sense of the Duma resolution supporting it."

"Are the Russians committed to actually giving up any pits?" asked the secretary of defense.

"Nooo, but some of them are sure thinking about it."

"My Gawd. What about the Geneva Convention that says we can't do it?"

A shrug. "The Russian ambassador thinks the Geneva Convention is going to be modified to permit preparing a prototype starship in the very near future."

"Well," said the secretary of defense, groping about in the cloud of gloom for the possibility of a silver lining. "In that case, maybe we can get a little money out of Congress to fund the sucker?"

"Well, hell," said Senator Metcalfe, the chairman of the Senate Appropriations Committee, a fashion plate

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straight out of *Arizona Highways* from the pearl grey Stetson on the top of his head to the ostrich-skin cowboy boots on his feet. "They put too much celery seed in the coleslaw, again. Proper barbecue needs a nice sweet slaw."

"I thought the coleslaw was excellent, Uncle."

"Don't get me wrong, Turi John, it's good slaw. The thing is, it's supposed to he'p set the stage for the barbecue, not be a star in its own right." He chewed a mouthful reflectively. "Be raht good with chili, though."

"Nobody seems to be complaining."

"Hell, boy, you think the movers, shakers and groupies at this do are going to come around and bellyache about the *coleslaw?*" Metcalfe threw back his head and laughed. "I'll bet most of them won't even leave any on their plates. You here lobbying for that Orion so-called Starship?"

"I'm afraid so, Uncle. It just seemed like it would be such a great thing. . . ."

Metcalfe looked at his watch. "I'll give you five minutes, my boy, because you ah my own flesh and blood. However, there are some other lobbyists here talking up that same cockamamie idea, and since they are paying in the traditional coin of the realm, I feel honor-bound to hear them out."

"What lobbyists?"

"The usual suspects. Izzy McWilliams, for the Rolls-Royce plant south of Dallas that would be making engines for any new clippers that get built. Billy Sol Harris for Gulf Hydrogen. A few others."

"They want to make money off of this?"

The senator nodded. "Nephew, they'll tell me that this bloody starship of yours means good times for Texas in general and them in particular, and how can you blame a man for wanting to make some money?"

"My God, Uncle! We're getting rid of the curse of nuclear war, we are, for Christ's sake, going to the *stars,* and you're talking about the goddamned pork barrel?"

"Ah, Turi, Turi, Turi. If the good ol' boys can't do well by doing good, there's a lot of good in this world would never get done. The president, he comes around and tells me, George, he says, I hate it, but it looks like we gotta have this one. Why? Because it will get him reelected, that's why. Does he like giving up the nation's crown jewels, all them little bomb pits we got stashed away so carefully? No, he does not. And to tell you the truth, neither do I, but if the Russians and the Chinese and the rest are willing, then we sort of have no choice."

"What's the point of keeping all that plutonium around if you can't use it or even threaten to use it, Uncle? Eventually some fool will get ahold of the stuff and blow us all to kingdom come."

The senator took a bite of barbecue and chewed thoughtfully. "It's like handguns, Turi John, only worse. For some people handguns are a drug; the guns give 'em a power high. Those people will not give them up. Remember that old bumper sticker, 'The only way to take my gun is to pry it out of my cold, dead fingers?' You may not like it, but those people sincerely mean that very thing."

"I don't like it, but I don't under-

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stand it either."

The senator pushed his Stetson back with his thumb. "Power is an illusion, boy—if people think you have power, then you have it. That works both ways, of course. If *you* have the illusion that you are powerful, then to a degree you are. You walk down the street and people get out of your way because you look so damned dangerous. But if you're wrong, watch out, you'll get the crap beat out of you. Or shot dead. That makes no never mind. People still cling to that illusion of theirs, that illusion of power, even though they *know* that it's dangerous, because it makes them *feel* so goddamned good."

"Nuclear weapons are different," said Ramos, loosening his Italian silk necktie with a nervous gesture. "Aren't they?"

"Hey, you were the one working for the UNNDC. When nuclear bombs are outlawed, only outlaws will have nuclear bombs, right?"

The senator does go off on the strangest tangents, thought Turi John. "You think the starship is maybe going to fall through the cracks?"

"Maybe, maybe not. You look too far in the future, Turi John, you get seriously confused. Space stuff is popular, and getting rid of the world's plutonium is popular. Plus once you build that prototype, you've got some momentum, but *then* will be when push comes to shove about all the hard stuff."

"You do think getting to Diomedes will help?" asked Turi John.

"Help the starship?" asked the senator, putting more beans and barbecue on his plate. "The slaw is good, Turi John, but a wee bit too tangy. Oh, sure, once Diomedes Station is in place and sending back data to build the real thing"—he paused to take a forkful of beans—"that'd he'p some, but only with the easy stuff."

"I wouldn't call designing a starship easy, uncle."

The problem is going to be prying those plutonium pits out of all the world's cold, dead fingers, thought the senator. "You think coaxing some 40,000 pits out of a country like India isn't going to be hard? India doesn't even admit to having that many."

Ramos hesitated and changed the subject. "Whatever. The project will still be a source of pork, and according to you, if there's money to be made from doing a thing, people will see that it gets done, right?"

Metcalfe shook his head. "Making money is one thing, Turi John, prying peoples' guns out of their cold, dead fingers is something else." He looked up; "HEY McWILLIAMS! C'MON OVER! Ah need to talk tew yew!"

Oh well, thought Turi John, piling more barbecue and coleslaw on his plate, the senator looks to be foursquare behind the prototype. He wandered off into the crowd as a Country and Western band struck up a melancholy ballad.

Dr. Sioux Kerry came up the tunnel with Winslow wheeling a basket full of starchy produce, red and yellow yams, russet potatoes, orange pumpkins and sweet corn. They brought the basket in for weighing at the cafeteria kitchen, as Colonel Levsky came up in fatigues with a load of radishes, peppers, tomatoes and cucumbers.

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"Hello, Sioux," he said cheerfully. "What do you think of the news?"

"You mean the starship, Pavel Ivanovitch?" said Dr. Kerry. "I'm not so sure it can be done. That's speaking as a Lunarian agrarian, of course."

"The physics seems entirely straightforward," said Levsky. "And once we evaluate the prototype, the engineering looks to be pretty much integrating several well-understood technologies."

"Chicken farming is a well-understood technology, and we're still trying to get chickens to thrive in *this* godforsaken place," she replied. "A starship will be ten times worse, and that's not counting eight years of intermittent acceleration at each end of the journey."

"The acceleration periods will be hard," he agreed. "But a starship! Man thrives on challenges."

"Challenges! I'll give you a challenge, Pavel Ivanovitch. Remember before we put the chickens in the centrifuge? On a six week growout cycle we threw 85 percent of the poor critters into the grinder to ferment and render them back into animal feed."

"And the animal feed tasted better than the chickens," Levsky said mournfully. "I remember. Lunar chickens are still tough and stringy, even in the centrifuge. You think we have not yet mastered the biosphere?"

"We aren't even close. If you fondly delude yourself that we've got the biosphere where we want it, look at how we're eating. You want to go to the stars on yeast protein and milk from that mechanical cow of yours?"

Colonel Levsky held up his hands, "Hey, that milk is for cheese and yogurt, not drinking."

"You want to go to the stars on yeast and ersatz cheese?"

"If I were going to the stars, I would surely hope to be fed better than here on Luna, Sioux," he conceded. "You think we aren't going to do as well?"

Dr. Kerry shook her head. "You know what it took to keep our beehives going? We had to install electromagnets to approximate Earth's magnetic field for them. And they're still on the verge of dying out, though the bumblebees seem to doing OK. Without the umbilical from Earth, we'd have failed long since."

"And a starship would cut the cord for sure," said Levsky. "How sad; I want to believe, I really do."

"The real problem with that starship isn't going to be the physics, Pavel Ivanovitch, it's going to be creating a sustainable biosphere that can be expanded when we arrive."

"Your turn, chief," said Winslow, writing the weights in his log book. "Are you one of the people looking to find a nice, delicious planet at the other end?"

The colonel rolled his basket up to the scale. "No, no, no, we will surely have to build in space, just as here on Luna."

"Building is one thing," Winslow replied. "Thriving is something else."

"More water would help," said Levsky, unloading the peppers on the scale. "Aquaculture is doing fine in principal, at least in those dinky little tanks, but we need to expand. If we only had a few hundred tons of water available, we could have all sorts of seafood."

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"We could do a lot with water," agreed Dr. Kerry. "If we were serious about a starship—"

"You listen to the news, Earth sure sounds serious."

"Hah! Ten years ago Earth was serious about building power stations, Winslow. No, for a starship, you need a working biosphere that can be expanded when you arrive. Maybe a hundred species of bonsai trees huddled together, all cramped and rootbound, waiting for The Day to become a vast forest."

Colonel Levsky wrote the weights into his log book. "Look," he said. "One of the problems with the Lunar biosphere is that we are critically short of water. Earth isn't stupid, they know that, so where are they talking about going with the prototype? Out where there's water, or at least ice, Diomedes, out in the Trojans."

Dr. Kerry looked up. "Ah, Pavel Ivanovitch. Water would help, it surely would, but how are you going to fit a working biosphere into a 100,000 ton starship when half the weight is devoted to the physics of transportation?"

"Biospheres can be any size, Sioux," he replied. "I have a working biosphere hanging above my computer, a sealed globe of water with an air bubble, tiny shrimp, and green plants, living in happy equilibrium together."

"I've seen it," she replied. "How big would it have to be to support 1,000 humans for a century or more?"

"Huh. Figure humans at 150 pounds each, times 1,000, 150,000 pounds, 75 tons. Figure they'd need 10 times their own mass in the next level of the food chain, that's what, 750 tons? Be generous and call it 1,000 tons. That's doable."

"And you don't like the food here on Luna, Pavel Ivanovitch? You'd need at *least* two steps, probably three. Two steps is 75 tons plus 750 plus 7,500, and that's for the living protoplasm alone! Don't forget the substrate; dirt to grow in, water to swim in, and air to breathe. Not to mention the energy to make the plants grow, and whatever it takes to keep the bees happy. Out of the 50,000 tons available for crew quarters, it looks like well over half is going to be biological."

CHAPTER 3
And The Shoot

"The House-Senate conference rejected the proposal this afternoon," said Madeline Tosca, leafing through the pages of the report. She was attending the informal staff meeting on the state of the starship, held in one of the lesser grandiose meeting rooms in the Rayburn House Office Building, by virtue of her undeniable talents. She was chairing it by virtue of her connections.

"Ah, here we are. Despite the Senate's vigorous efforts, led by the rambunctious Senator Metcalfe, the House appears to be unwilling to fund a prototype starship that does nothing except test the hydrogen bomb drive on a short test flight to Diomedes. The Honorable Stanley Wysinski says: "The Starship-prototype has simply too many problems needing to be solved to tackle them one at a time. When they reach Diomedes, the crew will have to *do* something,

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not just pile into the ship's boat and come on home. Does he have anything in mind?"

"Not really," said a senior staffer, newly come to the foot of the long, polished conference table. "My sense of Stan's position is that he's opposed, but he's looking for honorable arguments to use in this case, Doctor Tosca."

"I do not hold a doctorate," she replied gently. "If you wish to grant me an honorific, Professor will do; I profess to know a lot about practically everything."

"What *should* the Honorable Stanley W. have had in mind?" asked Turi John Ramos, cutting back to the question.

"There have been a few arguments among ourselves," Tosca reminded him, referring to the starship's supporters. "A few well-ventilated differences of opinion on the talk show circuit which might confuse the uninitiated. I expect the man would like us to reach a consensus before we start spending the taxpayer's money."

"You Americans," said Colonel P.I. Levsky looking bored rather than annoyed. "As my government has said before, to design a Starship one must work on the three main problems concurrently."

"What does your government think they are?"

"Well, Doctor Ramos, we all are working on the first two, of course, the drive, and the SRB," he saw Ramos's blank expression and explained the initials. "That would be the Stress Resistant Biosphere, for the generation ship. The third problem is: What do we do when we arrive? Once our prototype arrives at Diomedes, it must be prepared to build its own structures, its own habitats, which it must then infuse with the life from the ship's AHB, or Ad Hoc Biosphere."

"I'm not sure that your third problem corresponds to what the several groups arguing over the mission description have in mind," said Turi John, at last. "What task do you people want the prototype to perform, anyway?"

Levsky reached into his briefcase and produced a file folder. "These are the first results of that little robot flotilla that my government sent lightsailing off to Diomedes a few months back," he said politely. "You surely knew that Diomedes was part of a planetesimal system when you picked it out as your destination?" Turi John shook his head.

"No? Well, you had good staffwork, then. Diomedes rotates around a common center of mass with the smaller Automeden. . . ." he took out a glossy photograph. "And here, precisely at that center of mass is what appears to be a loosely consolidated lump of primeval matter, of, oh, about 2.8 cubic kilometers."

"Does it have a name?" asked Madeline Tosca, examining the photograph and wondering if it had been discovered on this side of the ocean.

Levsky nodded. "One of your technicians, Charlie Cavanagh over at the NASA Image Processing Lab, said it looked like a cowflop, and for want of a more dignified alternative, Cowflop it appears to be, at least on the working

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papers." He pulled out an analysis sheet. "The solids are unremarkable, mostly iron and silicates as one would expect, but Cowflop would appear to be about 12.6 percent volatiles, most of which is water. That's by volume, of course." He passed over the analysis sheet.

"Fascinating," said Turi John. "Utterly fascinating. But what does this have to do with anything?"

"My thought, which is my government's thought as well, is that this little crumb of a Cowflop—which is, you will note, over on page four, locked in rotation with Automeden and Diomedes—might be the prototype's natural destination."

"How do you figure?"

Levsky paused and looked around the table. "To put it as gently as possible, the prototype starship is huge and rather less than nimble," he said. "Simulated computer landings on either Diomedes or Automeden have had problems, not so much due to their high gravity or rapid spin, but because of the prototype's enormous mass and awkward drive mechanism."

Turi John nodded. The H-bomb drive was not the most flexible of instruments, and at 100,000 tons, there was no room to incorporate a chemical rocket system into the basic design. "How would Cowflop be any improvement, then?"

"It isn't spinning, for one thing. We *have* worked up a computer simulation which suggests that a close approach to Cowflop may be feasible."

"How close?" asked Tosca.

"Eventually we got down in the range of 2.0 to 0.2 kilometers, all short of collision, much better than what we started off doing. At 2.0 kilometers we can send a small craft over to Cowflop, run a line from prototype to planifitesimal, and *winch* them together."

"Don't you mean planetesimal?"

"For *Cowflop?*" Levsky laughed. "We combined planetesimal, meaning little planet, with infinitesimal, and it still sounds pretentious!"

"That addresses the docking problem, at any rate," said Wysinski's staffer, making a note. "Then what?"

"Well, then the crew unfolds the ship and sets it to rotating," said Turi John. "The, what did you call it, the AHB, gets established, and then everybody comes home."

"Incorrect, Doctor Ramos," said Levsky. "The prototype must be converted to space station mode, yes, I agree. That is, after all, the way it will travel once it is coasting at 3 percent the speed of light, and such a demonstration is an integral part of the feasibility study. But the crew must do more."

A sigh. "What else remains to be done, Colonel?"

"They must build something, Professor Tosca. First, they must set up a DSM," Levsky glanced at Turi John, and spelled it out. "A Dust Sorting Mill, Doctor Ramos. The initial use will be to separate out volatiles, water mostly, to enhance and support the AHB on the ship. Later, it will provide raw materials for the...." He paused. "The words 'conquest of space' are on the tip of my tongue, but they are the wrong words."

"What do you have in mind to do, then?" asked Turi John.

"Enclosure of a biosphere," replied Levsky. "Our cosmonauts must build an

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envelope and fill it with air. Air, water, soil, sunlight and life."

"That seems a rather excessive requirement, don't you think, Colonel Levsky?"

"At the end of this crazy, heroic star journey we are contemplating, if our cosmonauts find only dead, sterile planetary debris, they must be able to quicken it to life, mixing the dust with water and illuminating the mud with sunlight so that life, as we know it, can thrive. What tools will they need? What machines? What seeds? These are things we should try to find out."

Turi John looked up doubtfully. "Are you sure this won't kill the whole project?"

"Relax, Doctor Ramos," said Wysinski's staffer. "This is what the project is supposed to be doing, right? Suppose I pass Colonel Levsky's idea on up to Stan, and let our people check it out?"

"An excellent idea," said Levsky. "Excellent. Listen, if Representative Wysinski is interested, my office has been working on the details of such an ISB station. If he should be even a tiny bit interested, give me a call."

The staffer made a note, then looked up. "I will be asked," he said. "What's an ISB station?"

"ISB stands for *In Situ Built*, of course." He removed a card case from his pocket. "Here. Ask for Colonel Pavel Ivanovitch Levsky at either of these numbers."

"The problem, Pavel Ivanovitch," said Winslow, watching Lunar Three slowly turning as the shuttle approached, "is that labor is so infernally expensive up here."

"Ridiculous, I say. Why not just assign the people that are needed and get the job done?"

Winslow smiled. "Breathing is not a problem, theoretically. Theoretically, we have the power to rip the oxygen from the so-abundant silicate rock, and we can remove the carbon dioxide any number of ways. But. If you want men to work, you have to feed them, do you not?"

Colonel Levsky shrugged. "Perhaps, though this would not be the first time that large numbers of workers starved carrying out heroic projects."

"You have to feed them," said Winslow. "One hectare of land will support 12 people, on the average. We have . . ." he rubbed his chin and stared absently out the window, "about 23 hectares altogether, not counting a few potted plants mainly useful for decoration. That area would support about 276 people; when *we* arrive, the total will be up to 319."

"That is not nearly enough, we should have 1,000 construction workers alone."

"No, no, no. The trick is to work smarter, not harder."

"What do you mean? Work is work." Levsky shook his head in irritation. "Why not send up the 1,000 workers and get the job *done?*"

"You aren't listening. Cis-lunar space has 23 hectares struggling to support 300 people. Add 1,000 workers, you'll need another, oh, 80 hectares to support *them*."

"So dig more tunnels. The Moon has a world of room."

Winslow sighed and pulled a sad face. "The Moon has a world of room

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and not enough water to drown a gnat. Figure that you have to schlepp up one ton of water for each of those 1,000 temporary workers you want to bring up, and you can see why we're working smarter, instead."

"That would be what, a half billion dollar charge for the water?"

"And that's for just the water. Probably you want to put most of those 80 hectares we need in orbit, where the work will be done. How much did Lunar Three cost?"

"Too much," conceded Levsky at last. "Way too much. But working 'smart' as you call it is an invitation to catastrophe."

"No," Winslow shook his head. "It used to be that the hardest thing was to make the plan. Now, with the latest version of UltraSuperHyperCAD, we can make changes on the fly, and retrofit where needed. We don't even have to get the approval of the central planners; the people doing the work are their own experts."

"Luna hasn't got room for a bureaucracy," Levsky agreed. "In the past, I, myself have put my hand to gardening, and kitchen police besides." He hesitated, thinking of his protracted efforts to make the BBC give milk. "Give me an example of something that was solved on the fly. Give me a for instance."

"Well, being a metallurgist, I'll give a metallurgical example. I helped work out the aluminum slurry technique, for instance." The original plans had called for fabricating steel pipe in orbit, which proved to be impossible to do on the scale needed. The aluminum slurry technique used lasers, a fly's-eye lens, and an electric field to grow sapphire whiskers from molten aluminum under oxygen. Periodically, the aluminum was stirred, and fresh whiskers were grown. The viscosity of the slurry provided the cue to when the batch was done, and when the ratio was 2:1 aluminum to aluminum oxide whiskers, the batch was cast into a billet. Luna Base then shot up the billet to Lunar Three, which remelted it and fabricated the slurry.

"You mean the machine that slip-casts the pipe for the big rocket chamber?" The "big rocket chamber" was a geodesic hemisphere 2,000 meters in diameter.

"No, no, no. The machine that *feeds* that machine."

"I see. You support the machine that builds the starship?"

"Machines, Pavel Ivanovitch, great, greasy gangs of machines. That's why we don't need 1,000 workers to get the job done. The machines do the heavy lifting, and we're here to supervise them."

"Very good?" Levsky looked dubious. "NO! This is too fancy, too baroque. They should have stuck with the original plan, using iron pipe!"

"What are you ranting about? Originally they were going to use iron pipe because iron was dirt cheap. On parts of the lunar surface you can pick up iron with a magnet." Winslow rubbed his chin. "Aluminum needs to be refined, and the sapphire whiskers need to be grown, yes. But machines are doing all of those things. The aluminum composite is better, and *it* is cheaper because it needs less labor input."

Levsky sighed and shook his head.

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"How is my government to project national power, to display will, machismo, heroism, when an objection based on mere cost accounting is treated as if it was serious?"

"What is your complaint? Or your government's complaint? We are ahead of schedule and under budget."

"In some circles there is resistance to giving up the national armamentarium," said the colonel at last. "The prototype is moving along wonderfully, yes, but the true starship, the one we shall build after the prototype, *that*, my friend, may never be launched."

The train of modules encased in the six recoil tracks moved slowly back to battery, the starting place where it would stand when the first hydrogen bomb was exploded in the vast reaction chamber. Appearances were deceiving; the tracks, together with the modules, now fully loaded, had about the same mass as the great, geodesic hemisphere that formed the reaction chamber. The two parts of the system were moving in equal and opposite directions, but the human eye, looking at the huge, shining hemisphere compared it with the comparatively insignificant train of modules, and attributed all motion to the train of modules.

"A pity we can't fire a test charge or two," said Morgan, the former Navy test pilot detailed from NASA via the United Nations to command the prototype starship. "It goes *back* easily enough."

"The total mass is 112,850 tons," said Colonel P.I. Levsky. "Once it starts moving, stopping it is going to be a bitch. Or do I mean "son of a bitch?" Your idiomatic expressions are confusing at times."

"Either is correct," replied Morgan easily. "Though bitch conforms to current usage." He sighed. "What a pity they won't let us do a little practical testing before we take that hot, hot motor out for its trial run."

"The world has been doing test runs on the propulsion system since 1945," observed Dr. Sioux Kerry. "You can't blame the general public for not wanting to let the experts play with their oh, so dangerous toys any more than is absolutely necessary."

"Don't worry about it," said Madeline Tosca. "The engineering is quite conservative. One of the things the prototype will do is show us what we can cut."

"The recoil rails are overbuilt," Morgan agreed. "While the support for the modules . . . you might be able to drop the gross weight by 10 percent."

"That will be decided when we have the engineering data that the prototype will provide," said Dr. Kerry. "In the meantime, I have got to establish the biosphere we want to take."

A timer sounded. The modules had returned to their original position. "It's 18:32.6!" said Morgan with satisfaction. "That means that we don't have to start reloading the chamber from the magazine until we have a full stop. All right!"

"When are we going to start?" asked the Russian.

"When we're ready, of course, Colonel Levsky. But it will be soon, now. Days, rather than weeks."

The estimate of "days" was opti-

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mistic, but soon, soon thereafter the prototype starship slipped its moorings, pushing itself slowly away from Lunar Three under the impetus of mass drivers mounted on tiny space tugs. When the prototype was properly aligned and on the far side of the Moon from Earth, the main engine was started, firing one hydrogen bomb every half hour, as the voyage to Diomedes got underway.

Thirty-four days later, at the end of what proved to be a routine trip, Captain Morgan detonated a fifty-kiloton squib in the giant reaction chamber, to match velocities with the planifitesimal Cowflop at a distance of just under a kilometer. When the prototype starship had converted itself to "Diomedes Station I" it looked like a great mirrored bowl pointing at the Sun. Inside the bowl was the heat engine driven by sunlight, and behind the bowl was the torus of modules that enclosed the biosphere. To provide gravity, the torus was spun in one direction, while the bowl and heat engine were spun in the other. The whole assembly was balanced on three of the unshipped recoil rails, which were firmly grounded on Cowflop's newly arrived industrial complex. One rail sat on the dust sorting mill and chemical plant, the other two sat on the steel plant and the glass and aluminum plant, respectively.

The leadership council met in the module that now sat next to the cafeteria end of the crew quarters module. There was light, air, and a fair approximation of normal gravity. On the wall was a poster of Cowflop, and on the table was a model of the newly reconfigured space station. "We seem to be set up, more or less," said Madeline Tosca, checking the light setting on her videocamera. "Now what?"

"We have these questions from the 'MacArthur-Levine News Hour,' said Hewlitt Morgan. "They've been in—I guess you could call it e-mail—contact with us for the past couple of days. Anyway, they've scripted out the result, and we're supposed to read our answers."

"What's the point?" asked Winslow.

"Human interest translates into public support for the project," said Sioux Kerry. "Read the first question."

"Supposedly this will be Morton Levine speaking," said Morgan. "He's going to congratulate us for making history and segue to the question: "Now that the *Dyson's Dream* has successfully landed, what are you going to do?"

"Start making stuff," Colonel's Levsky offered. "Steel wire, aluminum slurry billets, glass ingots. We get the raw materials on hand, we can figure out how to use them later."

"Can we edit him out?" asked Dr. Sioux Kerry from the other end of the table. "I'd like to take the question."

"Go ahead," said Morgan.

"Thank you," she replied. "We begin by enlarging our biosphere, which means expanding into the pressurized, gravitized and illuminated modules right here in Diomedes Station. Why? At normal consumption rates our food stores will be exhausted in about three months, and there is no prospect of resupply. Either we feed

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ourselves or starve."

"The lady has a point," Levsky said at last. "And perhaps she should expand on it. What will it take to expand this cramped and inadequate biosphere of ours?"

"Start with water," Dr. Kerry replied. "Then dirt. We'll have to make the dirt."

"You have a recipe?"

"I have several, Winslow, but we're starting with water. We'll fill up the fish tanks, adjust the pH, and let the water come to equilibrium with the aquatic plants. Then we introduce the fish, and feed them all that single cell cr—protein that gets rendered out of the digestors."

"That pretty much covers the first question, I guess. Then Levine wants to know: 'What's the worst news you've discovered for the starship, proper?'

"That would be me, again," said Dr. Kerry. "In thirty-four days of hard traveling we lost about half the chickens. No way are they going to make it through a longer trip."

Morgan nodded. "What was wrong with them?"

"They were dying is what was wrong. Figure that on a real trip to the stars you'll be accelerating for years instead of weeks, and you can scratch the chickens."

"The stars will belong to the Orthodox Vegans?" asked Morgan, deviating from his script. "Moving right along, when you get around to actually building a local space station out here, what will it look like?"

"Power panels," said Winslow. "We'll start off by doing a Diomedes Electric, analogous to Lunar Electric."

"Unmanned, of course," added Colonel Levsky.

"Of course," agreed Winslow. "Potentially, the biosphere could soak up all the power we can produce. So rather than argue over the allocation of resources, we'll create new resources, starting with power."

"The public isn't going to give a damn about unmanned solar power plants," said Morgan. "That's old stuff; Lunar Electric was designed thirty or forty years ago. What are we going to build for *people?*"

Stepping from behind the camera the flamboyant Tosca looked up. "Winslow, trade places with me so I can take that one." And when she was sitting behind the table she looked straight into the camera, radiating personality. "The power plant *is* designed for people. Everything we do here is designed for people. The station on the drawing board right now is a refined version of the tire and tube design that was put up at Lunar Three."

"And just how was it refined?" asked Morgan, feeding her the question.

"The shielding in the 'tire' is going to be heavier, for one thing. For another," Tosca hesitated, sorting through a mental list of changes. "Lunar Three has mirrors reflecting the sunlight through glass windows on the inside surface of the 'tube,' so that one deck of biosphere gets insolated."

"That's right," said Morgan. "They tilt the mirrors to make day and night."

"So that half the time we aren't using the mirrors. The new station, call it

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Diomedes Three, will have an array of parabolic mirrors, like the ones that insolate the tunnels at Luna Base."

"How would this be an improvement?"

"The mirrors will feed the sunlight into optical fibers, which run to light pipes, and the optical fibers can be switched back and forth between *two* decks of biosphere. Which take turns with day and night."

"Levine wants to know how long you think this will take to complete?"

"Let me take that one," said Winslow, and he traded places with Madeline Tosca. "The answer is: It depends. If everything goes well, we could have the jig set up for fabricating the tire and tube in about six months. After that, we'd cast one or two-meter increments a day until we got the torus completed."

"A couple of years, you think?"

"If everything goes well, Captain Morgan. So far, so good, but you never can tell when something will go wrong."

CHAPTER 4
Then Comes The Frost

"That completes our news-making interview with the cosmonauts out at Diomedes Station," said Morton Levine. "We now present a pair of experts to discuss what it all means. With us tonight are Rear Admiral Henry Fontaine, USN, Retired, who is now a fellow of WISH, the Washington Institute for Space Habitation." Fontaine smiled and nodded. "And Captain Mary Ellen Bauman, from the NRDC, the Naval Research and Development Command." Bauman simply nodded.

"Admiral Fontaine, let's start with you."

"Thank you, Morton. From where I sit, it looks like all the problems of the starship proper have been solved, or are easily soluble. As far as physics and engineering go, we know how to build the ship, already. In fact, I think the prototype could have successfully made the trip."

"What about the problems with the livestock?"

"It would appear that joke someone made about Orthodox Vegans has an element of truth to it, Morton. Certainly you aren't going to be driving great herds of cattle down the Centauri Trail, but I'm told that a few of the chickens survived the trip."

"Chickens will never go to the stars," agreed Morton, quoting a popular joke. "Do you think that all the other systems are go?"

"Oh, absolutely. And out at Diomedes, the prototype has successfully converted itself from a nuclear-powered spaceship to a working space station. I just can't tell you how pleased we are over at WISH."

"How does the NRDC see it, Captain Bauman?"

"There's still a lot of work to be done, Morton, possibly requiring a major redesign. The two most serious problems are the biosphere and the neutron flux from the H-bomb drive."

Levine nodded, and consulted his briefing papers. "Take the neutron flux, first."

"Of course. According to our dosimeters, the radiation in the crew quarters increased from a stable background of 0.125 standard cigarettes a

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day to about 1.5, a 1,200 percent increase."

"That's a big percentage, but a couple of cigarettes a day isn't all that much, Captain Bauman."

"The prototype made a short trip, Mister Levine, 34 days. Going to a star would extrapolate to 200 to 300 cigarettes a day at the end of the acceleration, and another 200 to 300 cigarettes a day at the end of deceleration a century later. Not very healthy, I'd say."

"Ten packs a day? I should say not. What about the biosphere?"

"The preliminary indications are that more work needs to be done, Mister Levine. *Much* more work."

"What does WISH think about the biosphere, admiral?"

"There are problems, certainly. Especially if you insist on megafauna like chickens. But the solution isn't all that complicated. Go with a water substrate to raise fish and shellfish."

"You'd cut out meat and milk and eggs?"

"To go to the stars I'd eat fish. But milk we've got; the mechanical udder from Purdue University worked just fine, converting grass into milk. You want eggs, maybe caviar will do. Besides, installing a lot of aquariums would help with the neutron problem."

Morton Levine raised his eyebrows. "Explain that for our audience, please."

"The water would serve as neutron shielding, of course. What you end up with is tanks of water serving double duty as shielding and media for growth."

"Wouldn't the water get radioactive absorbing the neutrons?"

"Not especially," Fontaine shook his head. "Mostly it would be hydrogen picking up a neutron to go to deuterium—which is stable."

"Do you think a redesign is called for, admiral?"

"A redesign, yes, based on what we learned from the prototype. Restudying the whole idea, as Captain Bauman wants to do? I would say not."

"You don't think the radioactivity is a serious problem?"

"A strong case can be made that the higher radiation Captain Bauman talks about is an artifact of the way it's being measured, of particular placement of the dosimeters. The important thing is to remember that we have to take chances to get anywhere, we have to stick our necks out."

"What about the biosphere, Captain Bauman?"

"We need to know a whole lot more than we do, certainly. I understand that the bees survived by putting the hives in a refrigerator, so that they stayed in hibernation for the thirty-four day trip. That wouldn't work on a real trip."

"What about the biosphere, Admiral Fontaine?"

"There may be problems with the livestock," Fontaine conceded. "My suggestion to go with fish tanks was quite serious. I always did enjoy seafood, in spite of being raised Catholic." The admiral sat back in his chair and looked pensive. "An aquatic regimen has always been an option for the biosphere."

"We need to wrap this up, I'm afraid. Captain Bauman, what do you

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think the next step for the starship ought to be?"

"They need to go back to the drawing board for a complete rethinking and redesign. Yes, we made it to Diomedes, but that proves absolutely nothing."

"Admiral Fontaine?"

"Very little redesign is needed, Morton. Make the ship a little longer, a little narrower, maybe. Add a little more shielding, especially if it can do double duty. And that's about it."

"Thank you for being here, both of you. Our next story concerns an intelligence analyst, Mister Julien Ying who now is going public with the news that he made up facts to suit his bosses. Mister Julien Ying." Ying was Chinese, conservatively dressed in a dark blue three-piece suit with a yellow power tie.

"How do you do, Mister Levine."

"So far, so good, Julien. I understand that you were an analyst for the Defense Intelligence Agency?"

"That is correct, Mister Levine. For fifteen years."

"And your specialty?"

"I prepared estimates of the inventory of nuclear weapons for different nations. We used technical means and human resources, and most often they would be in close agreement."

"And what happened?"

"Well, ten years ago I had the India desk. At that time my supervisor requested a high estimate."

"Your supervisor told you what to find?"

"Not exactly, Mister Levine. Only he wanted a higher number than what I provided. Not once, but repeatedly; not marginally higher, but much higher."

Levine's eyebrows went up. "How come?"

"I asked the same question. Once I understood that *his* supervisor wanted to please the joint chiefs of staff, I, of course, furnished him an appropriate number."

"And what number was that?"

"I said that India had 40,000 warheads."

"And how many did they have, really, Mister Ying?"

"I don't know. Perhaps 200, perhaps as many as 300, if they chose to fabricate mostly tactical weapons. The real number is almost certainly smaller than 200."

"Isn't this top secret?"

Ying looked inscrutably at the camera, "Only the document has been classified top secret. The information which that document purports to contain is, in fact, wholly fictional."

"My goodness. Are you telling us that you made it up out of the whole cloth?"

"That is correct, Mister Levine. I arrived at the number arbitrarily, well, not quite arbitrarily. My supervisor hinted at the number he would like for his boss, and I guessed at what would make them happy."

"How could you justify such a monstrous deception?"

"Once the number was in hand, I worked backwards and contrived a supporting basis for it by falsifying technical intelligence reports." A wry smile. "We cannot discuss the numbers involved, of course. Revelation of such fine detail might reveal the inner

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workings of our military intelligence."

Morton Levine sat back, completely flabbergasted. "My God," he said at last. "You were playing games with the national security?"

"Sometimes the lies people tell reveal more about them than the truth one might be seeking," replied Ying, blowing smoke without tobacco. "But in any event, India has never adopted a threatening posture towards us, so there have not yet been any unintended adverse consequences."

"But why did the joint chiefs want a high estimate?"

Ying smiled politely. "Ask them, please. I could only offer ignorant speculation."

"Well, maybe we'll get around to it, then. Tell me this: How is that you are now breaking this story?"

Julien Ying gazed at the camera beneficently, his inscrutable Oriental face a finger raised at his host. "For the good of my country, of course."

Lunar Three spun serenely on its axis, the inner tube racing against the more slowly turning casing, as the whole assembly went coursing sedately in its orbit around Luna, exactly as if nothing were wrong. "What did you find about the neutron leak?" asked Turi John Ramos fretfully. "That stupid radiation the NRDA was so exercised about."

The engineer looked bored and called up the file on his workstation. "It *is* an artifact," he said. "Look. Here is the prototype in profile. The bomb explodes; the neutron burst passes through the length of the ship before the recoil even begins. Now look at the cross-section of the ship; we take one module at a time, in shades of grey showing neutron shielding. The circular image grew darker and darker as successive modules were added. What do you see?"

"Three little light spots, otherwise it looks pretty much black."

"Very good, Doctor Ramos. Now what do you see when we place the dosimeters—the little red crosses—in the crew module?"

"The dosimeters are placed exactly in the middle of the least shielded areas?" exclaimed Turi John.

"Amazingly, that appears to be the case," agreed the engineer. "So there is really no problem with neutron contamination or radiation leakage." He paused a beat. "At least no technical problem."

Dr. Ramos missed the inference completely. "Good, good. What about the redesign?"

A shrug. "We're still working on it, chief. My guess is that we can reduce the unloaded mass by maybe 10 percent. More if you reduce the biosphere."

"You people have no sense of urgency," protested Turi John. "We need to get construction started the day before yesterday!"

"Oh?" A pause, as the engineer called up the PERT chart and studied it for clues. "We can start on the reaction chamber, at any rate. Our modifications there were pretty simple-minded."

Turi John nodded. "What about the rest of the starship?"

"Come *on*. Building the reaction chamber will take enough time so

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that we can finish the redesign on the recoil system. You don't want the recoil system screwed up, do you?"

Fish got to swim, engineers got to fiddle with the damn design, thought Turi John. "I remember the rule," he said at last, "Anything you want done will take longer, cost more, and make a bigger mess than you ever thought possible."

"Yes, indeedy," agreed the engineer cheerfully. "That's the rule, all right. Are you so sure you want to make a rush job out of building the starship?"

"Hunh. My charter is I can do *anything* except spend money without permission. Well, get started on the reaction chamber, then, and see what can be done about the recoil system."

"We'll do that, chief. What about the biosphere?"

The biosphere had been the subject of an ongoing series of discussions. "It looks like one hundred people will be too many. Scale it back."

"We figured on seventy-five as about optimum, chief."

"So go with seventy-five, then."

"Yes sir. How are you going to feed them?"

A sigh. "It'll have to be aquatic, mostly. Which means fish tanks. Design them to hold. . . ." Turi John hesitated. "As long as we're wishing, we might as well go for what we really, truly want. Let's call for the basic garden, plus 1,200 tons of water in assorted tanks."

"All ri-ight! Uh, how are we ever going to get our hands on 1,200 tons of water, chief?"

"The old joke was: If God wanted us to go to the stars, He'd have given us the money. All *we* need is a little water."

Five astronomical units distant, the staff of Diomedes Station considered the problem, first on the one hand, then on the other. "We can send the ship's boat off by remote control," said Levsky, doubtfully. "With 1,200 tons of water, uh, I mean ice, it would arrive at Lunar Three in about four months."

"That will be fine for them," Winslow replied. "But how will *we* get home, then?"

The question: "Can we build another boat?" evoked a variety of responses, and a lot of computer work. The tentative answer: yes, but it would take a long time."

"Look," said Dr. Kerry. "We wanted to go to the stars. We *still* want to go to the stars. But you've got to figure that if we send off the ship's boat, we aren't going home."

"We could go home, we *could*." Winslow studied his computer for a moment. "Only at the end of seven or eight years, instead of maybe three."

"Or maybe ten or eleven? Or fifteen? No. Sioux is right. We aren't going to go home without the ship's boat. The starship isn't going to leave without the water we could send them."

"Earth could send up the water."

"It could, but I'm afraid it won't," Colonel Levsky shook his head. "Earth is having serious second thoughts about the whole affair. The NRDA is claiming that it has authority over the design and planning process, and wants Lunar Three to shut up and shut down."

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"What's Turi John doing at Lunar Three?"

"The fool is pushing ahead," replied Winslow. "CAD is too widespread for the NRDA to claim a monopoly on the design process, so Doctor Ramos is building the starship in defiance of orders."

"The design Turi John wound up with is pretty damn good," said Madeline Tosca. "Once they get our water, all the starship will need to get under way is that great shitload of hydrogen bombs from Earth."

Colonel Levsky looked morose. "My brave comrades in the military will hate to give up the power, the authority which that plutonium represents, but I think they would have no choice." He paused, "But."

"But if we send the boat off, you want to know what will happen to us here, Pavel Ivanovitch?"

"That's right, Sioux. How are we doing? Maybe more to the point, how will we be doing in the future?"

She sat back in her chair and considered the question. "I don't know how we—the crew—are doing, but the biosphere is doing very well indeed. How are the various construction projects going, Winslow?"

"Diomedes Electric is up and running," he said. "So we have plenty of power. We could expand it to take the nuclear reactor off-line if you wanted."

"I thought it *was* off-line?"

Winslow shrugged. "We're using it for mining and refining," he said. "Currently, we've got the biosphere running entirely on solar."

"How about Diomedes Three?"

"Look out the damn window; we're working on it. Right now we're mining raw material and refining it into stuff. Like, we're spinning steel cable and processing aluminum into slurry. The templates and jigs are being cut in the shop, already, and we ought to get started assembling the tube and casing pretty soon, now. Then comes the rigging, of course."

"And after the rigging is installed, Winslow, we install the air, water and soil for the biosphere?"

"And the germs and worms and compost, yes, yes, yes. All that organic shit!"

"Speak with respect of that shit, sir," said Colonel Levsky. "It is your once and future dinner. How long, do you think, until you can walk around Diomedes Three in your shirtsleeves?"

"The target date, you mean? The Christmas after next."

"About the time we'd be starting back for Earth," said Dr. Kerry quietly. "Myself, I would be more inclined to move into Diomedes Three. The interesting part would have just begun."

Madeline Tosca stood up, pumping her fist. "YE-ES! Let's get the human race moving in the right direction, for once! I say we load the damn boat with water and send it back to Lunar Three!"

There was more discussion, but in the end that was what was done.

On Earth, the collection of fuel for the starship ran into difficulty as grossly optimistic estimates ran into an unyielding reality. In the highest circles of government, this difficulty provoked both consternation and a certain grim satisfaction.

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"These promises are, of course, conditional," said the secretary of state. "Promises made by sovereign nations can hardly be otherwise. Even if the nuclear devices we have identified were already in place on the starship, however, a problem would exist."

"What is the problem?" asked the president, who already knew pretty much what it was.

"The problem, sir, is that the starship needs a fuel load of 300,000 hydrogen bombs," replied the secretary of State. The CIA's *latest* revised highest estimate is that if we collected all the bombs in the world, including all fissile materials suitable for making bombs, we could produce a total of 128,206 H-bombs."

Less than half, thought the President, with a touch of regret. "What about the DIA? They thought the figure was more than 10 percent higher."

"The DIA figure has been a joke since that fool went on TV and said he made up 40,000 H-Bombs for India."

"Oh, *him*. What a mess, what a bloody mess."

The secretary of state nodded. "Yes, sir. The Intelligence Community has been telling the men in power what they wanted to hear. When push came to shove, however, the crafty sons of bitches finally coughed up the real numbers."

"Well, then, suppose we collect as much fuel as we can, and send the starship off as fast as its little legs will carry it. Does it make a difference if they don't actually achieve 3 percent of the speed of light?"

"I'm afraid it does, sir," the secretary of defense replied. "The NRDA assures me that the power system has been taxed to the limit to provide the 140 years of safe, reliable service that are required. Three whole centuries would be simply out of the question."

"The idea was to get rid of all the damned plutonium," the President said at last. "Isn't the crew willing to take a chance 300 years down the line? My God, where is their patriotism?"

"The crew isn't the problem, sir," said the secretary of state. "The crew is keen to fly, and I'm sure they'd be willing to take their chances with the power system."

"So what *is* the problem, then?"

"The problem is that any number of countries, including, I'm afraid, some members of our own congress, and even some members of this administration," his eyes flicked over at the secretary of defense, "do not wish to give up owning nuclear weapons. Given this pretext—technical, yes, but political as well—the promises we have so laboriously collected are totally worthless."

The president poured himself a glass of water and took a slow swallow. "You're telling me that that the 99 percent complete starship orbiting Luna is a non-starter?"

"It can *not* be fueled for the trip to Alpha Centauri, sir," replied the secretary of Defense. "Therefore, it isn't going to go. Unless, of course, we are prepared to resume the massive production of nuclear weapons to support this harebrained scheme."

"That's hopeless," sighed the president.

"Then if I may say so, Mister Presi-

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dent, this is probably a good thing. Without the threat of nuclear weapons, we'd be facing another world war within a decade, and God knows, we couldn't afford the build-up for a conventional war."

"Neither can anyone else," was the sour reply. "Given our cultural aversion to risk, we might lose if we even tried to fight one." The president sighed again. "I really was looking forward to launching a starship during my term of office, you know."

"I'm very sorry, Mister President," remarked the secretary of defense. "It just isn't going to happen."

"So what are we going to do with the *Dyson's Dream II* at this point?" asked the secretary of state.

"It's a UN project," said the president at last. "At least nominally. What we'll do is tell the UN, and see if they can work something out."

"What do you want them to work out?" asked the secretary of state.

It looks like the third wave into space has crested, thought the president sadly. "Whatever they can work out, of course. The diplomats can talk all they want, but I fear our starship is kaput." He hesitated. "Keep that report top secret for now, all right? It'll look better if it leaks from the UN."

On Lunar Three the starship was going forward more smoothly than could have been hoped, and the boatload of water en route from Diomedes was taken as proof of Divine satisfaction. In the highest circle of government, however, news of the water from Diomedes waited on the pleasure of the next highest circle. And in the *next* highest circle of government, that boatload of water was the last straw.

The bedside phone rang, and the secretary of the Navy rolled over and picked it up. "De la Haye here," he grunted.

"This is Juan Dominguez," said the voice on the other end. "I was just talking with the Lunar desk over at the DIA." A pause. "Were you asleep, Delay?"

Fitzgerald de la Haye glanced at the clock; 2:43 A.M. "Naah, I was having me a little insomnia," he lied. "Whut the hay-ull have you got this time, Juan?"

"Personal intelligence from Luna Base, old buddy. Our source up there passed on some information he felt was what we like to call 'speculative.' The guy on Lunar desk went and used technical sources to get essential confirmation."

Oh? The old brain started clicking away. Anything hot from the Moon didn't look to be real good at this point. "Ah thought we had those fellas tied down, Juan."

"Es verdad, Delay. The starship can't be launched without fuelling from Earth, otherwise, 300,000 hydrogen bombs. 'Sa whole point of the exercise."

"Oh, that's raht." But if they were ready to launch except for the bombs, we'd have a hard time refusing to send them on up. So we kept them short of . . . of water. "Ah'm in the picture, ah guess. What sort of information did your source come up with?"

"What got passed on was that the crew of the prototype starship is using their ship's boat to send 1,200

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tons of water for the starship being built on Lunar Three."

Oh, shit. The starship people had been after us to send up 50 tons of liquid hydrogen so they could burn it to 450 tons of water with lunar oxygen. And we, of course, have been putting them off because we don't want to give up our nukes. "And y'all confirmed this?"

"Some of it, Delay. Technical sources confirm that the ship's boat has been launched, and that Diomedes Station is powering it as the thing heads for the inner Solar System."

How long before that damn cargo of water gets to the Moon? Taking the crew back, the ship's boat would have been in transit maybe four or five months, something like that. Find out. Find out soonest? Soonest figures to be morning, after the people get to work. "You did the raht thing, Juan, old buddy. Thanks for the call, and fax your report to my office, will you?" de la Haye slid his feet into carpet slippers, and put on his blue bathrobe. Now what?

He shuffled down to the kitchen and nuked a cup of water in the microwave, stirring instant coffee and sweetener into the boiling water. "Hayull," he muttered. The NRDA had tried to get the construction to stop while they ran the design through their big old CAD machines. What happened? Volunteer machines came out of the woodwork. Goddamn Japs. So the design work on the starship, including all the stuff learned off of the damn prototype, that had been done. Try to argue "we can do it better" and they asked "how?" Try to argue the damn details, the dirty bastards made you look like idiots.

So they were doing the construction work, already, without so much as a by your leave. De la Haye studied the cup of coffee steaming in front of him. The starship, what did they call it, *The Dyson's Sphere II*? The sucker had a whole lot of popular support. Which meant the president wasn't real happy when they got out in front to slow down the wheels of progress. Which meant the cockamamie thing was tee-totally out of control.

Except for the bombs, there was nothing more that Earth needed to send up. Except for a few odds and ends of equipment, and, of course, the 50 tons of hydrogen to make water for the biosphere. Except for the bombs? Once the word got out that the starship was ready to go, the Navy would have to give them up.

He took a sip of hot coffee. "Hayull," he said again. Probably the starship would be ready to go about the time the water arrived from Diomedes Station. Then there would be all this drumroll of publicity about the biosphere being ready, and selecting the crew and all that. When was the last time they could be stopped?

De la Haye took another sip of coffee. Probably the last time the starship could be stopped would be before word of that 1,200 tons of water leaked out. Which could be any old time. All the Luna Base people had to do was hold a press conference. Which meant that the Navy had to move fast, real, real fast. He picked up the phone and called up the list of

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emergency numbers, watching them scroll by the little screen in the handle. His immediate boss, the secretary of the defense, was useless, but down the line his deputy assistant was Daniel Boyce Kelly, and it was Kelly's number that he punched.

"Danny Boy? Good. This is de la Haye." A pause. "Yes I know what time it is. And yes, it is that important. I wouldn't have called you if it wasn't *that* important." There was another pause. "Well, if you want to keep the Armed Forces nuclear it's important, anyway." De la Haye sighed and covered a yawn. "Well, no, not exactly. First I need to tell you what the problem is, Danny Boy. Just you listen up to what I have to lay on you, and maybe we can find a way out of this jackpot."

CHAPTER 5

That Nips The Root

The rotund and red-cheeked MacArthur looked concerned. "Tonight's lead story on the 'MacArthur-Levine News Hour' is the confrontation that has blown up over the American attempt to rotate our personnel at Lunar Three. Our guests tonight are Admiral Henry Fontaine of the Washington Institute of Space Habitation and the secretary of the Navy, Fitzgerald de la Haye. We'll go with you, first, Mister Secretary. What happened, sir?"

What a mess, what a mess, thought de la Haye. What had Kelly told him: "Tell the truth and shame the devil?" Easy for him to say, his ass wasn't on the line. "We decided to make some changes in the staffing of the starship, is all. Nothing major, just benching some people back to Earth and sending in the second team."

"You sent up the entire American section of the High Skies Fleet just to change a few people? Sir, for some time now we have been told that those ships were inoperable; that they couldn't fly to carry needed supplies into orbit."

This is not going well, not going well at all. "Well, Mac, our ground crews finally got them working, and we figured, well, we figured we wanted some team players working on the starship." A sigh. That football analogy was just plain stupid, de la Haye decided, no way in hell would anyone buy Turi John as a quarterback not taking orders from the bench. "The fact is," he said at last, "Doctor Ramos up there on Lunar Three was completely out of control. We gave orders; he ignored them. We asked to review plans; he sent us new plans, supposedly incorporating our objections."

MacArthur nodded and looked directly into the camera. "Why then did your people up there go along with him?"

Under stress, Haye's accent began to thicken. "Foah one thang, that man is charismatic as hay-ull, sort of like a cult leader. Foah anothuh ouah people up there really, *really* want to see that starship launched, they-all want to see it launched so bad that they have become a cult, soht of. If'n that man Ramos tells them the orders we send up is trying to delay the stahship, they *bee*-lieve the tacky sonofabitch an' do what he tells 'em to do an' not what we tell 'em needs to be done."

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"You had a mutiny?"

The word was a dash of cold water. Counsel had handed him his head over using the term "mutiny." "Wa-all, not exactly." What were the weasel words they used? "What we had was more like a flaming outburst of zeal fueled by excess enthusiasm. This enthusiasm led Doctor Ramos and his people to—uh—to overstep their authority. We ah going up there to restore the authority that rightfully belongs to the people of these United States."

"By substituting Naval personnel for the American citizens which our government assigned to the UN? Didn't the UN complain about this usurpation of authority?"

I think Ah may have blown it, Haye decided. Well, too frigging bad. "One question at a time, Mac. No, the UN did not complain. What-all we are doing is changing one set of people assigned to the UN for another set. Also assigned to the UN."

"How come you didn't tell anybody? The starship is a UN project, isn't it?"

De la Haye nodded impassively. There hadn't been time to tell anybody, but if you say that, the sonofabitch will want to know what the hurry was. "Why, yes, of course the starship is a UN project."

"Right. Why didn't you tell people you were going up?"

As Lady Macbeth said: "If t'were done, t'were best done quickly." But I can't tell *him* that. "Ah regret the failure of communications that seems to have taken place heah, Mister MacArthur."

"Hmm. Yes, of course. Why are the other nations so exercised about all this?"

"I swear Ah don't know, Mac. Maybe over at state they'll be bettuh informed. What-all I read in the papers is that they seem afraid their civilians can't work with ouah military, and that, of cou'se, is ridiculous."

"Admiral Fontaine, why do you think the other nations are so exercised?"

"Look at what was done, sir," was the cool reply. "We went and replaced the American civilians up there with American military. How did we do it? Secretly. Suddenly. Unilaterally. We are currently in de facto control of Luna Base, Lunar Station, Lunar Electric, and all of Lunar Three that we want."

"But wasn't the base mostly manned by Americans?"

"No, of course not. We paid about a third of the bills, we supplied about a third of the personnel—civilians, mostly, detailed to the UN."

"Wasn't the UN Command merely a fiction, admiral? A pretext to let the great powers do what they wanted in space?"

"Yes, yes, Mister MacArthur, the UN Command *was* a fiction. But it was a fiction agreed to by the great powers." Fontaine sat forward and glared at the camera. "What happened to the UN command up there? We brushed it aside like it was nothing. Who gets upset? Not the UN, but the other great powers the UN was fronting for."

"But what are they upset about?"

"The militarization of space. It looked like we were engaged in building a starship, to which we would commit the world's arsenal of hydrogen bombs. After this, nobody is going to hand over their bombs no matter

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what we tell them." Fontaine shook his head. "Not to the US military."

The fat man looked pained. "But why not?"

"Good God, sir! We have just demonstrated that the US flat-out can't be trusted, and you ask me why nobody will trust us?"

There was an inaudible remark offstage. "What's that?" asked MacArthur, turning to the right.

The camera panned to the wings, showing Morton Levine holding a jaggedly torn fax. "We have a report that Turi John Ramos was murdered while in US custody," he said, walking onto the sound stage. "Mister Secretary, do you have anything to say about this shocking abuse of military power?"

De la Haye blotted his perspiration-bespangled brow with a trembling hand. Running would be the end, an admission of guilt. But what to say? When in doubt blow smoke. "In the first place, if these very serious allegations should possibly prove true, Ah have heard nothing, nothing about any casualties on either side. In the second place, Ah expect that boy might have been depressed the way things were turning out, he being a such a flaming fanatic on the subject of starships, an' if Turi John should, in fact, be dead, it might well have been bah his own hand. In the third place...."

The secretary of the Navy was saved by sheer, dumb luck. The career-destroying Turi John Ramos murder/suicide controversy vanished into thin air as the show's producer walked onstage with a second fax message, which he handed to Morton Levine.

"The Russian squadron of the High Skies Fleet has gone into low polar orbit," Morton read. Then he looked into the camera with wide, wide eyes, pancake makeup blotchy on his suddenly pale face. "If they are armed, they have taken up the classical attack posture!"

Diomedes Station watched the unfolding drama with all the detachment afforded by half a billion miles distance. The manner in which the drama was unfolded unto them was this: Earth routinely beamed twenty-six channels to Lunar Station; of those twenty-six channels, Diomedes could select any four, which were then relayed to Lunar Electric and beamed to Diomedes. Since it took ninety minutes for a channel change to take effect, channel browsing was rather less spontaneous than on Earth, or even Luna.

"Stupid summit meeting," said Winslow, coming into the lounge. "What good will that do?"

"It might stop a few billion people from getting blown up," replied Dr. Kerry. "Including, of course, the summiteers. You're just in time to hear the commentators tell you what the official communique already told you." They sat and watched, sifting through the redundancy and banality of the four TV channels available to them, like miners panning for gold.

"It looks like they got themselves off the hook," said Winslow at last.

"Hook, indeed," said Madeline Tosca. "What this reminds me of is

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professional wrestling. A lot of face making and screaming in agony as they follow the script."

"What script? What do you think is happening?"

"Oh come on, Sioux, it is so *obvious*. Look at the deal they cut: *Everybody* leaves Luna Base and Lunar Three. Then the Russians explode their nukes—the ones carried by the Deep Space Fleet—in the vicinity of Lunar Three. On the far side of the starship, where the US can count them and verify their destruction, of course. Then everybody left on Lunar Station is evacuated. In the process the starship gets seriously trashed, and the Lunar complex will be well and truly gutted."

"Gutted?" asked Winslow. "They said they were taking care to do no harm to the physical structure of the Lunar bases."

"Right," said Tosca. "At least, that's what the lying sons of bitches went and told us. In the meantime, who benefits from all this play acting?"

"Well, a few billion people get a reprieve from nuclear annihilation," Dr. Kerry replied. "That has to count for something."

"*Su-ure* it does. And in the process the starship project gets knocked in the head." Madeline Tosca looked mournful, like Medea about to kill her children. "So the boys in the military get to keep their atomic toys."

"You think the whole thing was the military trying to keep their nuclear weapons?" asked Winslow.

"Well of *course* it was, dear man. Look at how the crisis started, how it developed."

"How *did* it start?"

Tosca sighed. "The US abruptly deployed their squadron of the High Skies Fleet to correct what they described as an "intolerable situation" on Luna Three. Turi John Ramos was, all of a sudden, an out of control berserker."

"Oh, come *on!* Turi John was *always* a loose cannon. They put the man on Lunar Three to keep him out of trouble."

"Yes, yes, Doctor Kerry. Only something happened. From the timing, I'd guess that our shipment of water might have been what tossed the match into the fireworks factory."

"That might have been the hidden why," agreed Colonel Levsky. "How about the stupid what?"

"Things were driven by unauthorized military actions on both sides, and then the politicians running around like chickens with their heads cut off, trying to play catch-up. What did they end up doing?"

"What the military wanted?"

"Very good, Pavel Ivanovitch. That's exactly what they ended up doing. Depend on it, if the disarmament people try to start up the starship program again, it will be found that awful things have happened to the Lunar infrastructure when nobody was looking."

"What's the chances of launching the starship from here, then?" asked Colonel Levsky.

"Small and none," said Winslow. "It ain't going to happen."

"We couldn't make ourselves a reactor and separate out the Pu-239?"

"Oh, we could make the fuel, I sup-

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pose, Pavel Ivanovitch, but it would be a full time job for more people than we have available."

"I'm not even sure we could make the fuel," added Dr. Kerry. "At least not in the quantity needed for a trip to the stars. Right now we're in good shape to survive, but that'll be a full time job for the foreseeable future."

Madeline Tosca nodded her agreement. "We could—no, the fuel could be made, eventually. But *we* wouldn't be making it. It would be our children, or grandchildren."

"You know, I really hate to give up on the starship," said Colonel Levsky at last. "Isn't there some way we could entice poor old Earth to look towards the stars again?"

Sioux Kerry nodded. "It has to be worth thinking about," she conceded. "If anybody comes up with anything, we surely ought to give it our best shot."

Time passed, and the drone cargo ship with 1,200 tons of water approached perihelion under remote control from Diomedes Station. The mass drivers, powered by the photovoltaic panels on the ship were entirely sufficient to bring the ship to rest with respect to the abandoned Lunar Three, a fact that did not go unnoticed on Earth.

On the "MacArthur/Levine News Hour," Morton Levine looked impassively into the camera as the disclaimer that this interview had been scripted to accommodate the long time lag between questions scrolled across the bottom of the screen. "After several months, the starship was once again back in the news this evening as a drone cargo ship out of Diomedes Station matched velocities with Lunar Three where the hulk of the *Dyson's Dream* remains docked. We now bring you a newsmaker interview with Professor Madeline Tosca, from Diomedes Station. Professor Tosca, what cargo is that drone of yours carrying?"

"Water in the form of ice, Mister Levine, twelve hundred tons of it," said the extremely photogenic Madeline Tosca. "And you may call me Madeline."

"Thank you, Madeline, and you may call me Morton if you would like. You people out at Diomedes Station aren't exactly having an easy time of it. Why did you try to help us out with that shipment of water?"

"Well, Morton, you have to remember that all of us here are very much interested in the possibility of going to the stars. When we dispatched our ship's boat, we thought the water it carried was going to help get the starship off to a good start."

"Not an unreasonable assumption, but in any event it didn't happen. How do you feel about there being nobody on Luna to take delivery?"

"Chagrined. Upset." Madeline Tosca laughed, belying her words. "But after you think about it a little, it's kind of funny."

Levine looked sternly into the camera. "Be serious. That ship's boat was your way *home*. How can being stuck out in the asteroids be funny?"

"*We* aren't stuck. *You* are the ones who are stuck, stuck on Earth with all those nuclear weapons."

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Her host nodded in pained agreement. "Eh, well, I'll admit they gave us a few bad moments back there. But how do you figure that *you* aren't up the creek without a paddle, if I may muddle a metaphor?"

"We could build another boat eventually, Morton. It would take us awhile, is all. The thing is, right now we're busy building other stuff." She smiled, showing her strong white teeth. "Go on, ask me what we're building."

"What are you building?"

"I'm glad you asked. We've enlarged Diomedes Electric, and scrapped the plans for Diomedes Three."

"I assume that you have something in mind as a replacement?"

"Oh, yes, Morton. This is a shot of the model of the new Turi John Ramos Station, which is set beside a model of Lunar Three for comparison." The camera panned around both models, showing them from different angles. Both were tube and casing structures, but the TJR Station was much larger.

"Are they done to the same scale, Madeline?"

"Yes, of course. The other big difference is that the TJR Station will have all the water it can use. The TJR biosphere could easily support three or four thousand people. Lunar Three was laboring to support two-hundred."

"To put that in context for our viewers, your crew is only 113 people, with no additions any time soon—" Madeline Tosca interrupted him.

"No additions is simply mistaken, Morton. Doctor Sioux Kerry and Colonel Pavel Ivanovitch Levsky are expecting a baby in a few months, so they got married." A pause. "I phrased that lousily, but they aren't the only ones, either."

"Well, good luck and congratulations to all concerned, I suppose. How long before the TJR Station is completed?"

"We were originally supposed to be coming home by next Christmas," she said, considering the question. "This, this is pretty ambitious. It will take at least another couple of years to complete the tube and the casing, and I don't know how long the rigging will take. TJR Station won't really be complete until the biosphere is supporting a shirtsleeves environment. Four, maybe five years, at a guess."

"Well, at least you seem to be enjoying your work. *Then* will you build a boat to come home on?"

"You weren't listening, Morton. Right now, Diomedes Station *is* home, in spite of everything. TJR Station also looks to be shaping up as home; you work on building something like that, you *do* form an attachment to it."

Levine nodded. "Yes, yes, I concede the point. I could never sell that summer cottage I built, even though it came in a kit. But what are you all going to do once the TJR Station is finished and done with?"

"That," she said with her most dazzling smile, "will depend on what needs to be done, won't it, Morton?"

"We're almost out of time here, Madeline, but tell me, what do you *think* will need to be done?"

"Get work started on the starship, again. What else?"

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"Hopeless, Madeline, utterly hopeless. As the man said: 'Starships is dead.' What makes you think you can resurrect them?"

"Mysticism, Morton. As the voice of God said: 'If you build it, they will come.' "

One of the advantages of a long time delay is that it gives you a chance to do research. "That was the Kevin Costner movie, *Field Of Dreams,*" he said easily. "But how does baseball connect with building a starship?"

"Different dreams for different people, of course."

Levine looked doubtful. "Maybe you know what you're doing, but what if all those people don't share your dream? What if they don't show up?"

"They'll show," said Madeline Tosca calmly. "I have faith in my dream and faith in my people. They *will* show."

"Eventually," he agreed, nodding. "But not right now. We've run out of time, Madeline. Thank you for joining us."

She smiled, and her eyes twinkled. "No, Morton, I think you mean: 'Thank you for *not* joining us.' " ■

They also say that every time a star blinks it makes a difference to each of us, so powerful are the laws of cause and effect . . . it may make a difference to you.

—Will Cuppy

Mistakes are seldom serious unless repeated.

—Anonymous

Wise living consists, perhaps less in acquiring good habits than in acquiring as few habits as possible.

—Eric Hoffer

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THE REFERENCE LIBRARY Tom Easton

Feersum Endjinn, Iain M. Banks, Bantam, $12.95, 312 pp. (ISBN: 0553-37459-1).
Ill Wind, Kevin J. Anderson and Doug Beason, TOR, $23.95, 383 pp. (ISBN: 0-312-85760-8).
Gaia's Toys, Rebecca Ore, TOR, $22.95, 317 pp. (ISBN: 0-312-85781-0).
Realtime Interrupt, James P. Hogan, Bantam, $12.95, 326 pp. (ISBN: 0-553-37454-0).
Norstrilia, Cordwainer Smith, NESFA Press (P. O. Box 809, Framingham, MA 01701-0203), $20.95 (+ $2 s&h), 249 pp. (ISBN: 0-915368-61-7).

Gasp. It's astounding. Wheeze. It's astonishing. Gosh,wow. It's even amazing.

Wonder of wonders, and would you believe it? This is my two-hundredth "Reference Library"—somewhere near two thousand book reviews (I haven't even tried to count those)—and I find it a little hard to believe myself. When I started back at the tail of the '70s, I hardly dared to think that I might hang in here so long, but here I am and—let me check my pulse—yes, I'm still going strong.

Doesn't it get to be a grind? Don't I ever crave a break?Well, sure, sometimes, but by and large I enjoy the job. A lot of the books I cover I would read anyway, and by now writing down my thoughts about them is more habit—an enjoyable one—than chore. I've been known to say some remarkably stupid things,though I try not to. I still try to cover books that seem likely to appeal to the *Analog* audience, along with a little fantasy,some popular science, some criticism, and the occasional item that is interesting because it seems bound to push your buttons or rattle your cage. Occasionally I pick up a book of a sort I usually ignore, just to give it a chance. I still read what I review (I note at the time any and all exceptions to this statement), I don't take my reviews from jacket copy or puff sheet, and I definitely do not follow that old adage about saying nothing if I can't say something nice (How can you trust a reviewer who is always positive?). If a writer comes up to me at a con and asks, "Please read my book," I do, and then I review it; sometimes they wish they hadn't asked. To be more timely than *Analog*'s six-month lead-time permits, I invite writers to send about-to-be-published manuscripts on disk; a few have taken me up on this offer and been pleased with the results. I've made one or two editors the same of-

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fer, but they have not taken me up on it.

I hope I'm better at it than I used to be. I know I'm better at it than certain amateurs who think a few reviews in regional newspapers qualify them to pontificate on what reviewing is all about.

I don't plan to quit quite yet. If you wish I would, well,you're stuck with me (unless you're Stanley Schmidt). If you're glad I plan to stick around—bad jokes, snide cracks, dumb comments, and all—I'm delighted to know you're there and here's a variation on an Irish toast: *May we be together for another hundred columns, and one more to apologize for our sins.*

I hope I'll have the sense to quit with time enough left to find out whether I'm missed.

And now, what do I have for you this month?

Iain M. Banks continues to amaze and delight with his latest novel, **Feersum Endjinn**. At the same time, he manages to irritate the dickens out of the reader—me, at least—with one particular character, Bascule, who claims to have a sort of dyslexia that makes his recorded reminiscences come out in weirdly phonetic orthographic rebuses, like so: "I fot Id better clear it wif thi relevint oforities furst & hens avoyd any truble (like happind thi lastime) so I went 2 c mentor Scalopin. Certinly, yung Bascule, he sez, i do beleave this is a day ov relativly lite dooties 4 u u may take it off, 1/2 u made yoor mattins calls?"Maybe Banks has been bitten by William Steig, perpetrator of *CDC,* a collection of cartoons such as the one showing a group of pygmies surrounded by large bones and tusks, captioned, "V F E-10D L-F-N." It's quite amusing in small doses, but Banks goes on for pages, visits the minds of his other characters—the soldier,Sessine, who has just suffered his last few deaths—wham! Wham!WHAM!—and is desperately trying to figure out what is going on the young woman who has just awakened in a crypt and wandered off, thinking, "Oh, yes. That's grass. The sun. A man. . . ." the scientist, Gadfium, who is intrigued by moving stones and strange messages, and more—before returning to Bascule for even more pages.

Oh, well, that Banks can do it at all, much less for such a sustained performance, is something of a marvel even if it is irritating. Perhaps we should look a little deeper: His world is a far, far future Earth dominated in at least one region by the Castle, a construct whose towers reach all the way to space,whose furniture is mesas, whose walls are mountain ranges, whose king's palace is constructed inside a chandelier. Storms sweep through open windows, volcanoes rumble in the back shed, and Banks proves quite convincingly that his imagination can beggar anyone else's. Wow.

Yet the people who built the Castle are long, long gone, off to the stars, leaving Earth and its marvels behind, in the keeping of lesser folk. The Castle is falling into disrepair, and a war is being fought over access to something that may or may not hold the

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key to escape from a cosmic cloud sweeping across the sky, hiding the stars, and threatening both to freeze Earth and blow up the Sun.

The Castle is not the only relic of the distant and more glorious past. There is also the Crypt, an immense repository of information including the personalities of the dead (abstracted down to whatever of them is unique; most people make very small contributions to the Crypt); the Crypt is also the key to how I can say Sessine is on his last death: each person has an allotment of deaths; after each one except the last, the Crypt manufactures a new body and reanimates it. That young woman, who soon decides her name is Asura, turns out to be a construct of the Crypt, its emissary to the world, her mission to seek out the ancient mechanisms that will permit Earth, the Crypt, and the remnants of humanity to escape disaster.

It does not take long for Banks to reveal this much, nor that the powers that be have their own agendas, best served by stomping on any potential disruptive influence—Sessine, Asura, Gadfium, even Bascule. Yet, after a suitable period of wandering across Banks's marvelous landscape, the obligatory magical mystery tour, they come together and indeed find the answer to Earth's plight.

If you can stand orthographic-phonetic-rebus overkill, yool find a grate deel hear 2 luv. So buy it.

The latest book by Kevin J. Anderson and Doug Beason reminded me powerfully of *Mutant 59: The Plastic Eaters,* by Kit Pedler and Gerry Davis, which appeared in 1971 and worked out its scenario in a way that the Clute/Nicholls *Science Fiction Encyclopedia* calls "less than crisp." As I recall, it struck me as quite implausible, but I can't check, for though I could have sworn I had a copy around the house, I can't find it.

Anderson's and Beason's **Ill Wind** seems more plausible,perhaps because biotechnology has come a long way since 1971(nobody had heard of "recombinant DNA" before 1973), big,disastrous oil spills are a stain on recent memory, and bacteria that can eat spilled oil have in fact been developed. So Anderson and Beason are not producing just another "Oh, horrors!"paranoiac fantasy—no computer viruses that can infect humans, no ozone holes that let solar heat burn up the Earth's surface, no brainsucking coneheads hiding in ice cream parlors and they're camouflaged in what you just bought and they're gonna get you NOW!

You know what I mean. On the other hand, you also know by now that *Ill Wind* has to be a disaster novel; the difference is that it is much better justified than a great many others of the kind.

The tale begins as a supertanker, the *Oilstar Zoroaster,* approaches San Francisco. A disgruntled crewman, who believes that whatever goes wrong is always someone else's fault, pulls a fire alarm to draw the captain off the bridge so he can steal his personnel file. He also brains the mate and locks the bridge so the captain can't get back where he belongs until it is too late to keep the tanker from

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ramming one of the Golden Gate Bridge's supports. San Francisco Bay is soon awash in crude oil,activists are screaming their heads off, and the Oilstar company is desperately looking for a way off the hook. Fortunately, one of their researchers has developed a bacterium that can eat oil.The company pushes it as the only option, even some of the activists go along although others are more inclined to go ballistic ("Oh horrors! Genetic engineering!"), and as soon as it has approval—and before the protesters can get the inevitable court injunction—the company gets a helicopter in the air and sprays the bay.

Unfortunately, the researcher responsible for the bug has personal problems. The bacterial sample he supplied for testing is innocuous, but as the spray settles over the water and the local traffic jam, the authors have him think, "He had given the Earth a legacy. Nothing like the *Zoroaster* spill would ever happen again. Guaranteeing that was worth sacrificing everything."

Very soon, the reader learns what he means, for the cars in the traffic jam start running out of fuel. The bug is eating gasoline. It's contaminating gas station storage tanks. It's eating plastic and synthetic rubber and. . . . The oil spill is vanishing before your eyes, but the cars won't run. Neither will computers. Windows are falling out of buildings. Planes are falling out of the sky. Plastic soda and milk bottles are turning into mush. Civilization is headed down the drain fast.And the situation is not being helped by the Neanderthal chowderhead who is now in charge in Washington, telling the military to keep the nation under control at all costs.

Fortunately, some people have more sense. *Ill Wind* is their story, for its focus is on their efforts to rebuild despite crumbling infrastructure, cannibal gangs, and control-freak generals. A group in White Sands is trying desperately to put experimental solar power satellites to work to generate electricity. Another wants to move the extra satellites in storage in Pasadena to White Sands using steam locomotives,railroad hand cars, horse-drawn wagons, whatever it takes. Others just want to hang on, perhaps rebuilding just enough to hold one last rock concert. And all succeed.

Many of those who worry about the hazards of technology blame not scientists and engineers but science and engineering for whatever problems arise, whether small or large. It is not people who make trouble, they insist, but their institutions.Anderson and Beason remind us that it is people who make trouble, generally because of aspects of their lives that have little to do with science or engineering, even when the people happen to be scientists or engineers. And it is also people who bail us out of the trouble people make.

What do science and engineering do? They provide us with answers to the questions we ask. They help us do whatever it is we wish to do. In *Ill Wind,* they let a single tragic figure create a world-wide disaster. They also let the survivors begin to pull things back together.

It's worth noting that those sur-

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vivors share the belief that one is responsible for one's own actions; unlike that disgruntled crewman, they do not look for others to blame whenever something goes wrong. In touch with reality. Facers of facts. Just the sort of people we so often see in this magazine. Maybe even the sort who read it.

Rebecca Ore is a horrible cynic. What else can you say about a lady who thinks that in the future, our society will give welfare clients brain implants or drodes so their brains can be used as a cheap substitute for fancy computers?

If she were recommending that, we might call her a Republican. But, of course, she's only being realistic, saying that current attitudes could easily lead in the direction of such intimate exploitation. And this is a point she makes in other ways as well in **Gaia's Toys,** her latest.

The tale begins as Mattie Higgins drives a car loaded with high explosives into a New Orleans refinery. She thinks her mission is eco-sabotage, striking a blow for Ma Nature, but as the cops descend on her, her secret masters turn out to be nasty sorts: she was really carrying a small nuke, and now the Gulf Coast is something of a mess.

So's Mattie. The Feds have her under the squid, scanning her memory for every little thing she remembers, not just her masters but also the parents who abandoned her, the orphanage,the sex shows (fear of disease has led to gangs who mount their girls on sex machines and hold orgasm races, among other things).When she agrees to cooperate, they shoot her full of nanobeasties to reshape her face, test her by having her play fox to trainee hounds, and finally fit her with drodes and aim her at Dorcas, a perpetual post-doc researcher suspected of illegally making genetically engineered insects such as the mantises that seem to be pacifying the welfare cases.

Or are they? Meet Willie Hunsucker, disabled war vet and a drode-head whose mantis actually seems to be improving his thinking. In fact, he is finding that he can retain some memories of those times when his brain is being used by the system. One of his assignments sets him to helping the hounds look for a Mattie who has played fox a bit too successfully. He spots her but says nothing; before long he has fallen in with a group of industrial-accident victims whose huge legal settlements finance a range of activities including eco-sabotage.

Mattie is supposed to be Dorcas's computer and thereby give the Feds a way to spy and trap. Dorcas, who keeps her jobs by sleeping with her bosses, is indeed doing illegal genetic engineering, trying to devise bugs that can survive in a human-dominated world and even ameliorate just a bit humanity's more obvious evils; her current project is a wasp that can recognize incipient violence and provide a tranquilizing sting. She is thus another eco-saboteur, and it seems quite fitting that Ore's various threads come together to affirm the rebellion.

Gaia's Toys is well worth the reading, although I did not find it quite as satisfying as some of Ore's other nov-

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els, perhaps because she shows here a tendency to be a bit arbitrary, especially toward the end, imposing her authorial will too obviously, without developing events from the story's own conditions. On the other hand, it is worth asking what her title means. Are the genetically engineered insects toys? Are they our toys because we make them, or Gaia's because they serve nature's purpose (though we need to bear in mind that purpose is a human invention, not nature's)?

Or are human beings Gaia's toys, much the way Mattie,Willie, and Dorcas are Ore's own, as moldable as modeling clay and when one game is done to be reformed for another?

With **Realtime Interrupt,** James P. Hogan shows himself to be a modern master of the fictive info-dump. Hero Joe Corrigan awakens in a hospital. His memory is gone. Everyone around him is super-serious, lacking all signs of a sense of humor. He is told, "You were involved in some unconventional experiments involving processes deep in the brain, which have affected your mind and altered the way you see the world." Some memory returns—he worked with computers, he came from Ireland. He leaves the hospital, gains a new wife, takes a job as a bartender. Still, nobody gets his jokes.

There really isn't much mystery here. The jacket blurb gives it away: Corrigan had been working on inhabitable virtual reality, and he had let himself be used as one of the first test inhabitants. It isn't quite downloading, but it's close enough,at least from Joe's viewpoint. The computer has complete control of his senses (all but his sense of smell), and everyone he meets is a computer construct.

Or is that really true? Twelve years after his awakening, a woman walks into his bar. She gets his jokes. She, too, was a volunteer. And she's pissed—twelve years is a bit much, even if out there in the real world it's only three weeks. But what can they do? They are at the mercy of the corporate honchos who are running the test (it's no accident that an early version of the technology was called Pinocchio).

Or are they? The memories are returning steadily, and in them Hogan shows the reader the history of the project, its beginning as a fancy ultimate VR, its shift toward an attempt to train the computer to be an artificial intelligence by giving it real intelligences to interact with in its internal world, the takeover by marketers and managers and power-mongers to whom what the technology can do is less important that what they can get out of it, the reason for the memory loss with which Corrigan's current life began, and eventually the hint that there might actually be an escape hatch after all. And that hint becomes something to clutch at quite desperately when someone outside hits the reset button.

Clearly there is a great deal here for one to find interesting. Unfortunately, Hogan provides technical background in quantities that soon burden the reader's attention. It's not as bad as it would be if it were all in classic "expository lump"form, for it's broken

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up by dialogue and bits of action, but the overall effect is fairly dreary. It would surely be more tolerable if the characters were more memorable.

After many years it was a pleasure to reread Cordwainer Smith's only novel, **Norstrilia**, republished by NESFA Press with a number of corrections to earlier editions, an appendix of material added when it was split to make the two short novels, *The Planet Buyer* (1964) and *The Underpeople* (1968), and a historical introduction by Alan C. Elms.

Cordwainer Smith (1913-1966) was a remarkable writer. Born Paul Linebarger, reared in China and Europe, godson of Sun Yat-Sen, and employed as Professor of Asiatic Politics at Johns Hopkins University and as intelligence agent for Military Intelligence and the CIA, he brought to his writing wide exposure to world literature and showed the influence of the Chinese classics in much of his work. Elms notes this is particularly true of *Norstrilia*, which models to a large extent *The Journey to the West*, a seventh-century tale. *Norstrilia* is the story of Rod McBan the 151st, who journeyed from his home world, where grow the giant diseased sheep that supply humanity with the immortality drug stroon, to travel to Earth. His aim is to escape a plot against him; his means is to use his antique computer to corner the stroon market and buy Earth; the result is a morass of new plots which he must survive with the aid of the cat-based girly-girl C'mell, a friendly Lord of the Instrumentality, and a movement among the animal-based underpeople that owes more than a little to the early days of Christianity.

One of the most remarkable things about *Norstrilia* is how very, very well it holds up today. Smith's style still feels fresh, and what he has to say is still worth saying. If you haven't read this one, grab it now.

The book is part of the NESFA's Choice series, dedicated to bringing "back into print classic science fiction that is essential to any good collection, but which is becoming increasingly difficult to find as the publishing industry's backlist shrinks." The books of the series are printed on acid-free paper and solidly bound, and NESFA says it plans to keep them permanently in print. Also available is *The Rediscovery of Man: The Complete Short Stories of Cordwainer Smith* ($24.95).Coming soon will be *Ingathering: The Complete People Stories of Zenna Henderson* ($21.95).

Also available from NESFA is the 1995 Boskone book by guest of honor Diana Wynne Jones. *Everard's Ride* ($19.95; limited edition; ISBN: 0-915368-63-3) contains two never before published novellas, the title story and "The True State of Affairs," six other fantasies, and an article on Tolkien's narrative art. ■

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BRASS TACKS

Dear Stanley,

As an Einsteinian Relativist I had to write a Brass Tacks note about Donald Kingsbury's "The Janus Headed Arrow Of Time: . . ." (February 1995). He is clearly a quantum expert the way he took an axe to relativity.

Velocity in spacelike dimensions is *relative.* For us to "travel at 1.4 lightspeeds," we can only be doing it with respect to some other particular object. It is clearly impossible to do it with respect to all other objects in the Universe. (And *none* of the "travel" examples in the article have any such reference frames—invalidating all of them.) Note: if you are coasting at 1.4 lightspeeds with respect to an inertial reference frame, then *you* are in an inertial reference frame.

Under the normal rules of relativity and in their own reference frames, *all* objects travel "forward" in the one timelike dimension, with a velocity of one second per second. To change an object's spacelike velocity, you need to apply a force in the spacelike dimensions. Analogically, to move an object into any "past" in spacetime, it will be necessary to apply *timelike* forces to the object. The exact meaning of that statement is extremely complex, and I have never seen a convincing proof that it is possible. These FTL gimmicks are *all* fundamentally flawed—they confuse time with clocks. Even in this article!

Personal Clocks (P-Clocks for short) are independent of, and have nothing to do with the dimension of time! And the thing that becomes negative in FTL situations is a *stationary observer's impression of the movement of a traveler's P-clock!* An FTL traveler does *not* move backwards in the timelike dimension of spacetime! All objects and travelers subjectively see their own P-Clocks ticking forwards at one second per second always. That's a definition of being in one's own reference frame. P-Clocks are sensitive to your relative velocity to other objects. You see other objects that are moving or accelerating as having P-Clocks that run slow (or maybe backwards). Observing someone's P-Clock running backwards says nothing about time-travel. Yours or theirs. Even if they zoom by you at 1.4C. And if they do, you *will* see their clocks ticking backwards, and entropy *decreasing* for them. In relativity, you must always ask "When does the signal reach you?" Please try to visualize this. First, you see a spaceship right next to you (along with a blinding Cerenkov photonic boom). Next you see it as it was a second ago as the light it emitted *then* finally reaches you (since it's FTL). And etc. You see it traveling backwards, with its P-Clock ticking

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backwards, losing entropy. Looking in the other direction after the ship had passed, the red-shift (below zero?) would cause you to see nothing. The fact that observers see entropy decreasing in an FTL system might be the deal-killing paradox. Or the Second Law of Thermodynamics is wrong. Physics should always look right to all observers in all inertial frames.

Lastly, all the time-reversal arguments in this article are flawed. The author himself quotes at the beginning that "there is no time—only clocks." Trying to do a time-reversal by replacing T with -T in equations *only works in classical physics!* When you are trying to incorporate *relativity, there is no T! Only clocks!* To reverse time in any relativistic situation, the *only* thing you can do is to make P-Clocks run backwards. And let entropy decrease. And P-Clocks are generic—this applies to *any* clock! *All clocks!* There is no T!

If the author chooses to deny that entropy decreases under time-reversal then he can't do relativistic time-reversed calculations and his arguments rain down on his head and drown him anyway.

BRUCE EWING
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Eugene, OR
Sent from Oregon Telcom

The author replies. . . .
Dear Stan,

From the reactions to my article "The Janus Headed Arrow Of Time . . ." (February 1995), I suggest that readers bone up on their A. Korzybski. When I was 16 and reading A.E. Van Vogt's "World of Null-A" in *Astounding*, I learned a few things about the difference between symbols and the things they symbolized. I then went to A.K.'s *Science and Sanity* and learned more. In a nutshell: The symbol is not the thing; the word is not the object; the theory is not reality; the map is not the territory.

First: time-machines are all straw men. One normally sets them up and then knocks them down by establishing causal contradictions. I was knocking down my straw time-machines by using entropy and pointing out that it is highly probable that entropy will "non-decrease" in any description of a physical system whether we run our newtonian, einsteinian, or quantum equations forward or backward. This is a simple deduction from the time-symmetry of the equations. Nowhere does there exist a proof that entropy will decrease if we reverse time. That is an old wives' tale. Boltzmann himself showed that classical Boltzmann thermodynamics is time-symmetric.

Both Special (SR) and General Relativity (GR) are fascinating theories, but they have their limitations. For one, as a consequence of the fact that their equations have unique solutions, both predict that entropy is constant no matter in which time direction we are moving—therefore always non-decreasing. Unlike quantum mechanics they contain no mechanism for the loss of information transmitted from the past to the future. Both relativities contain not a single useful thought about thermodynamics. We must go

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outside of relativity to describe the thermodynamic clocks that are used to measure time in relativistic mechanics.

So—some readers didn't like my FTL time-machines. Fine, I think they are a crock, too, *and said so.* But please don't tell me that I am a relativistic ignoramus by quoting me a flawed proof. *What most brainwashed young physics students don't seem to understand is that, as of 1995, there exists no valid proof that FTL is impossible just as there is no proof that it is.*

The Lorentz transformations become imaginary when your velocity exceeds that of light. The special relativity "proof" allegedly negating FTL via the use of time paradoxes is built on some enthusiastic physicist's assumption that the square root of minus one equals minus one. That's how you "get" negative tau in those regions of the Minkowski diagram outside of the light cone and all those nice Minkowski lines that "send" messages and things into somebody's past. Shame! Garbage in, garbage out!

Physicists should note that the square root always has *two* solutions. Shame! Oh shame! If we make the equally silly assumption that the square root of minus one is equal to plus one, i.e. that tau remains positive as we pass through the light barrier, then all the causal conflicts with SR and FTL magically disappear, and even entropy comes out in a common sense fashion. Sure, we can "see" a man die in front of our eyes before we "see" him born elsewhere. But FTL or no, we cannot use what we see to create a paradox.

Non-simultaneity is not an issue. An FTL event cannot be observed and so cannot be ordered in any listing of sub-luminous events. An FTL ship can be observed up to the moment of cracking the light barrier and after the moment of dropping back through. Those events can be on our list, and can appear in different places on the event lists of other frames of reference. None of these lists can be used to generate a causal contradiction if tau is always positive.

Bruce Ewing grumbled that I have no frame of reference for my fanciful time-machines. Not so. They were all built in a London basement in 1895 and start their operation from that SR frame of reference—clearly implied. Bruce's specific complaint was the failure mode I suggested for my FTL "time-machine." I failed it by changing the sign of tau. He seems to think that this establishes an absolute frame of reference. It doesn't.

Bruce is shamefully wrong when he says, ". . . If they zoom by you at 1.4c . . . you will see their clocks ticking backwards and entropy decreasing for them." By the machinery of SR itself, you would see *nothing,* certainly not a blinding Cerenkov photonic boom and then the ship moving backwards, its p-clocks losing entropy. SR supposes the FTL universe and ours to be *disjoint* and *incommunicado.* Absolutely. Sorry, Bruce.

The Lorentz equations in the raw "say" that after moving at 1.4 lights relative to the Earth in the x-direction, and after one year of ship time, its coordinates relative to the Earth are: x =

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+ 1 .4i l-years, t = +i years. Make of that fantasy what you will! In conventional FTL time-machines, like the *Star Trek* voyage to San Francisco, the plus sign is chosen for x and the minus sign for t, don't ask me why. I chose the plus signs—why not? Everybody ignores the i.

Sober SR predicts that from Earth we could *not* determine the position or velocity of any object in the FTL universe. An FTL ship would disappear when it entered the FTL universe and reappear in some other place when it returned. SR is not a complete enough physical theory to tell you how a ship might do that, or where it might be when it's gone, or where-when it might reappear, or how energy in our Universe might be conserved during the disappearance, etc.

Even if you can reverse time in a world of alternate pasts, each with its own non-zero probability, you cannot recover any particular past. Time travel, in either direction, is a crap shoot.

DONALD KINGSBURY

Dear Sir:

The article "Faster-Than-Light" by Dr. Robert L. Forward (March 1995) does not consider the 4th Law of General Relativity, which states that the speed of light is affected by a gravitational field, in such a way that it is decreased by a negative gravitational potential, and increased by a positive gravitational potential.

Dr. Forward undoubtedly knows that this was verified for a negative gravitational potential in 1967, although light-speed enhanced by a positive gravitational potential has not been demonstrated because of the difficulty in finding areas of the Solar System where the gravitational potential is sufficiently positive to get a noticeable effect.

As with the Casimir effect, enhanced light-speed due to a positive gravitational potential is not a faster-than-light phenomenon, and therefore does not entail the possibility of a time machine, but it does increase the speed of light in a way which is potentially useful.

Theory and experiment surrounding the effect, as well as possible FTL phenomena, were discussed in the following references:

Kenneth J. Epstein "Is There a Future for the Tachyon?" *American Journal of Physics,* Vol. 53, p. 1130 (1985).

Kenneth J. Epstein, "Why Bodies Accelerate When Clock Rates Vary," *American Journal of Physics,* Vol. 54, p. 295 (1986).

Kenneth J. Epstein, "On the Velocity of Light," *American Journal of Physics,* (Vol. 55, p. 393 (1987).

Kenneth J. Epstein, "Hamiltonian Geometrodynamics," *Physics Essays,* Vol. 5, p. 133 (1992).

KENNETH J. EPSTEIN
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Chicago, IL 60626-5331

The author replies. . . .

Dear Stan:

Kenneth Epstein is correct. A photon will travel "faster-than-light" in a region of space that has a positive gravitational potential. I simply forgot to include it in the article. I should

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have remembered, since I discussed the weird things that happen in regions of space with positive gravitational potential in my August 1975 *Analog* article, "Far Out Physics" (see the equations in Fig. 14).

Of course, to make a region of space with a positive gravitational potential you need to have "negative matter"—which has yet to be found. But, as I pointed out in my August 1990 *Analog* article, "The Negative Matter Space Drive," negative matter is not forbidden by the laws of physics, so it probably exists—perhaps out in the "bubble voids" between galaxies.

DR. ROBERT L. FORWARD, PH.D.

Dear Dr. Schmidt:

"The Janus-Headed Arrow of Time: Entropy and Time Travel" by Donald Kingsbury was a heavy blow to my secret hopes. Then "Faster-Than-Light" by Robert L. Forward restored them. Since this may be of interest to other readers of *Analog* I would like to explain it. Before going any further, let me state that I am strongly atheistic and therefore my hopes don't get complicated with spirits, ghosts, souls or supernatural entities. Having said that I must admit that, since I live in a mostly Judeo-Christian environment, it is impossible for me to eradicate from my thoughts a certain Judeo-Christian flavor.

Some time ago, somewhere, probably in the pages of *Analog,* I picked up the Idea that a human being is a mind that exists and grows in a human body. Then, at the end of the film *Terminator II: Judgment Day* I saw the "good" terminator robot sink into a pool of molten metal. Its physical functions began to collapse and eventually the screen that represented its awareness and its mind shut itself off to a point of light like an unplugged TV set.

Now I see the same fate for myself. I am not planning to commit suicide by jumping into a pool of molten metal but the fact remains that sometime in the future my body will become unable to sustain its vital functions. At that point it will shut down my brain and kill me in the process. I have a problem with that.

The obvious solution is to leave my brain before my body shuts it down. Snakes molt worn out skin, hermit crabs move out of constraining shells, I would like to have the option to leave behind my old body when it quits working. The good news is that in science fiction this can be accomplished by a mind transfer. Roger McBride Allen describes it in *The Modular Man* (*Analog,* February-May 1992). The bad news is that I will die before mind transfers are possible and available.

That is when Kingsbury and Forward come in. In order to solve my problem, I need time travel. Kingsbury says it can't be done, Forward says it may be possible. I hope Kingsbury is wrong. If time travel is possible, all I need to do is to arrange to have a rescue team come to my deathbed from a future where time travel and mind transfers are possible. Before my body kills me they will mind transfer me into a portable unit. Then they will take me back to the fu-

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ture and download me into an electronic environment such as the one described by Frederik Pohl in *The Annals of the Heechee*. Then I won't have to die if I don't want to. Of course, if Kingsbury is right, I'm just dead.

The Judeo-Christian twist is that I get resurrection when the rescue team picks me up and eternal life in cyberspace when they download me. I like that because it breaks up the religious monopoly on life after death. I think competition is good for the market.

Let me finish by saying that I am glad *Analog* is around to keep our species doing what it needs to do in order to succeed, that is, to think ahead and to explore and find ways to improve its chances of survival in the centuries and millennia to come.

RUY BURGOS-LOVÈCE
Chapel Hills, NC ■

IN TIMES TO COME

In July 1994, Rick Cook and Peter L. Manly generated a lot of enthusiasm among our readers with their novelette "Symphony for Skyfall," about how the multiple impacts of Comet Shoemaker-Levy 9 on Jupiter that month might have looked to the folks who would really care: intelligent beings living in the atmosphere of Jupiter. We sneakily timed the story to appear about the same time as the real event, and to make the fictional events ones that really might have happened.

In the real world, we had no way of knowing whether they, or anything like them, did. An unmanned human spacecraft, *Galileo,* was on its way to Jupiter, but would not arrive until December 1995—about the time our Mid-December issue will be in readers' hands. Might the Jovian survivors of Cook and Manly's 1994 disaster notice and interact with it? They just might, which raises intriguing possibilities for a different kind of first contact. If you don't read about it in your daily paper, you at least can read it here, in Cook and Manly's new novelette, "Unfinished Symphony."Allen Steele, well known elsewhere, will be making his *Analog* debut with a novelette about the obvious way to avoid the Evils of Animal Experimentation—but its ramifications are a good deal less obvious. Donald F. Robertson's fact article "Reach Out and Touch the Stars" shows how the desire to improve something very ordinary and close to home may be the key to opening doors much farther away. And, of course, we'll have the conclusion of Lois McMaster Bujold's *Cetaganda*—and perhaps a little something for the season.

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UPCOMING EVENTS Anthony Lewis

24-26 November
CONCAT 7 (Tennessee SF conference) at Radisson hotel, Knoxville, Tenn. Guest of honor—Samuel R. Delany; Artist Guest of Honor—Joe Phillips; Special Guest of Honor—Allen Steele. Info: Chloie, 805 College St., Knoxville, TN 37921. (615) 522-3470. chloie@aol.com

24-26 November
LOSCON 22 (Los Angeles area SF conference) at Airport Hilton, Burbank, CA. Guest of Honor—Bob Shaw; Artist Guest of Honor—Lubov; Fan Guest of Honor—Larry Stewart. Info: Loscon 22, c/o LA Science Fantasy Society, Inc., 11513 Burbank Blvd, North Hollywood, CA 91601. (818) 760-9234. rbourget@aol.com

1-3 December
STELLAR OCCASION (Dallas area SF conference) at the Harvey Hotel Addison, Dallas, TX. Author Guest of Honor—Ben Bova; Industry Guest of Honor—Barbara Bova. Registration (to Phoenix Entertainment) $25. Info: Stellar Occasion, c/o Meri Hazlewood, 810 Blossom Rd. Garland TX 75041.

1-3 December
SMOFCON '95 (SF convention-runners conference) at Red Lion, Austin, TX. Registration—$45 until 20 November, $50 at the door. Info: SMOFCON '95, c/o FACT, Inc., Box 9612, Austin, TX 78766-9612. (512) 835-9304 before 2200 CT. meschke@chinacat.unicom.com

29 August-2 September 1996
L.A.CON III (54th World Science Fiction Convention) at Convention Center, Hilton, and Marriott Hotels, Anaheim, CA. Guest of Honor—James White; Media Guest of Honor—Roger Corman; Fan Guests of Honor—Takumi and Sachiko Shibano; Special Guest—Elsie Wollheim; TM—Connie Willis. Registration—$90 until 30 June 1996, $110 until 31 December 1995, then higher. Child-in-tow (3-12 in 1996)—$35, infants free, supporting—$30. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: L.A.Con III, c/o SCIFI, Box 8442, Van Nuys, CA 91409. lacon3—info@netcom.com

Convention runners: You can send me e-mail about your convention—A.LEWIS20 on the GEnie™ network. If your convention has a telephone, FAX, e-mail, or Web page, please let us know so that we can publish this information. Convention attenders: When calling conventions for information do not call collect and do not call too late in the evening.

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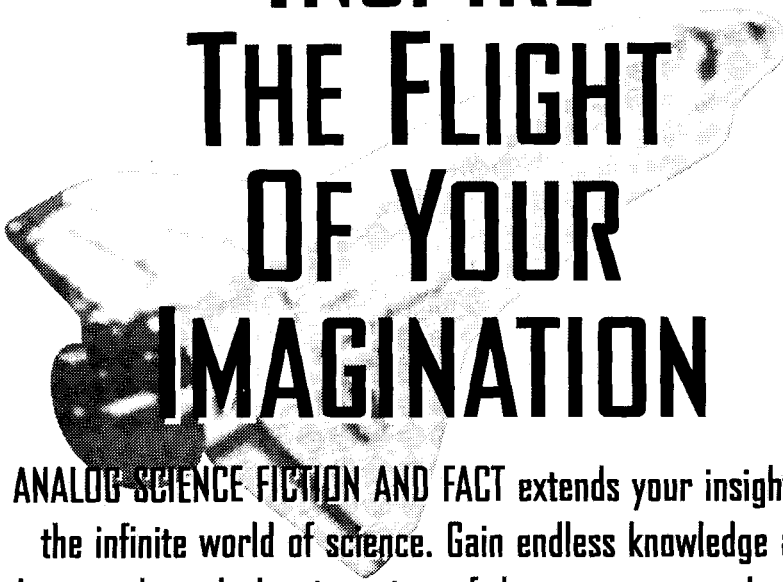

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